

EXHIBIT 1



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(54) **MULTI-PIECE SOLID GOLF BALL**

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This patent is subject to a terminal dis-
 claimer.

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908, 432, 526, 534

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(57) **ABSTRACT**

In a multi-piece solid golf ball comprising a solid core, an inner cover layer and an outer cover layer, the solid core is molded from a rubber composition comprising a base rubber composed of (a) 20–100 wt % of a polybutadiene having a high cis-1,4 content, a minimal 1,2 vinyl content and a viscosity η of up to 600 mPa·s at 25° C as a 5 wt % toluene solution, and satisfying a certain relationship between Mooney viscosity and polydispersity index in combination with (b) 0–80 wt % of another diene rubber, (c) an unsaturated carboxylic acid, (d) an organosulfur compound, (e) an inorganic filler, and (f) an organic peroxide; and the outer cover layer has a lower Shore D hardness than the inner cover layer. This combination of features gives the ball a good, soft feel upon impact and an excellent spin performance that provides increased distance.

9 Claims, No Drawings

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MULTI-PIECE SOLID GOLF BALL

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a multi-piece solid golf ball which has been imparted with a good, soft feel upon impact and an excellent spin performance that makes it possible to achieve an increased distance.

2. Prior Art

Various improvements are being made in formulating the polybutadiene used as the base rubber in golf balls so as to confer the balls with outstanding rebound characteristics.

For example, JP-A 62-89750 describes rubber compositions for use as the base rubber in solid golf balls, which compositions are arrived at by blending a polybutadiene having a Mooney viscosity of 70 to 100 and synthesized using a nickel or cobalt catalyst with another polybutadiene having a Mooney viscosity of 30 to 90 and synthesized using a lanthanide catalyst or polybutadiene having a Mooney viscosity of 20 to 50 and synthesized using a nickel or cobalt catalyst.

However, further improvements in the materials are required in the above art to achieve golf balls endowed with a good, soft feel upon impact and an excellent spin performance that helps increase the distance the ball travels when played.

JP-A 2-268778 describes golf balls molded using a blend composed of a polybutadiene having a Mooney viscosity of less than 50 and synthesized using a Group VIII catalyst in combination with a polybutadiene having a Mooney viscosity of less than 50 and synthesized with a lanthanide catalyst. However, golf balls with a good, soft feel upon impact and an excellent spin performance that helps increase the distance traveled by the ball cannot be obtained in this way.

The existing art also teaches multi-piece solid golf balls in which an intermediate layer is molded of a low-Mooney viscosity polybutadiene (JP-A 11-70187), solid golf balls molded from rubber compositions comprising a polybutadiene having a Mooney viscosity of 50 to 69 and synthesized using a nickel or cobalt catalyst in combination with a polybutadiene having a Mooney viscosity of 20 to 90 and synthesized using a lanthanide catalyst (JP-A 11-319148), solid golf balls molded from compositions based on a rubber having a 1,2 vinyl content of at most 2.0% and a weight-average molecular weight to number-average molecular weight ratio Mw/Mn of not more than 3.5 (JP-A 11-164912), golf balls molded from rubber compositions containing a high Mooney viscosity polybutadiene (JP-A 63-275356), and golf balls molded from rubber compositions comprising polybutadiene having a high number-average molecular weight in admixture with polybutadiene having a low number-average molecular weight (JP-A 3-151985). However, none of these prior-art golf balls truly have a good, soft feel upon impact and an excellent spin performance that helps increase the distance traveled by the ball.

Golf balls having a cover composed of a relatively hard inner layer and a relatively soft outer layer have already been disclosed in JP-A 6-218078, JP-A 6-343718, JP-A 7-24085, JP-A 9-239068, JP-A 10-151226, JP-A 10-201880, JP-A 11-104273, JP-A 11-104271, and Japanese Patent Applications No. 2000-274807 and 2000-274843. However, further improvements in distance are desired for the golf balls described in all of these specifications.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide multi-piece solid golf balls which are endowed with a good,

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soft feel when hit with a golf club and an excellent spin performance that helps increase the distance traveled by the ball when played.

The inventor has discovered that golf balls having a solid core, an inner cover layer over the cover, and an outer cover layer over the inner cover layer, wherein the solid core is made of a rubber composition formulated from a particular type of base rubber combined in specific proportions with certain other materials, and the outer cover layer is softer than the inner cover layer, exhibit a good synergy from optimization of the solid core materials and an appropriate distribution of hardness between the inner and outer cover layers. Multi-piece solid golf balls thus constituted have a good, soft feel when hit with a golf club and an excellent spin performance that enables the ball to travel further when played.

Accordingly, the invention provides a multi-piece solid golf ball having a solid core, an inner cover layer enclosing the core, and an outer cover layer enclosing the inner cover layer. The solid core is molded from a rubber composition comprising 100 parts by weight of a base rubber composed of (a) 20 to 100 wt % of a polybutadiene having a cis-1,4 content of at least 60% and a 1,2 vinyl content of at most 2%, having a viscosity η at 25° C. as a 5 wt % solution in toluene of up to 600 mPa·s, and satisfying the relationship: $10B + 5 \leq A \leq 10B + 60$, wherein A is the Mooney viscosity (ML_{1+4} (100° C.)) of the polybutadiene and B is the ratio Mw/Mn between the weight-average molecular weight Mw and the number-average molecular weight Mn of the polybutadiene, in combination with (b) 0 to 80 wt % of a diene rubber other than component (a). The rubber composition includes also (c) 10 to 60 parts by weight of an unsaturated carboxylic acid and/or a metal salt thereof, (d) 0.1 to 5 parts by weight of an organosulfur compound, (e) 5 to 80 parts by weight of an inorganic filler, and (f) 0.1 to 5 parts by weight of an organic peroxide. The outer cover layer has a lower Shore D hardness than the inner cover layer.

The polybutadiene (a) is typically synthesized using a rare-earth catalyst.

Preferably, the diene rubber (b) includes 30 to 100 wt % of a second polybutadiene which has a cis-1,4 content of at least 60% and a 1,2 vinyl content of at most 5%, has a Mooney viscosity (ML_{1+4} (100° C.)) of not more than 55, and satisfies the relationship $\eta \leq 20A - 550$, wherein A is the Mooney viscosity (ML_{1+4} (100° C.)) of the second polybutadiene and η is the viscosity, in mPa·s, of the second polybutadiene at 25° C. as a 5 wt % solution in toluene. The second polybutadiene in component (b) is typically synthesized using a Group VIII catalyst.

In the multi-piece solid golf ball of the invention, it is generally advantageous for the inner cover layer to have a Shore D hardness of 50 to 80 and the outer cover layer to have a Shore D hardness of 35 to 60.

DETAILED DESCRIPTION OF THE INVENTION

The golf ball of the invention includes a solid core made of a rubber composition in which the base rubber is at least partly polybutadiene. It is critical that the base rubber contain as component (a) a specific amount of a polybutadiene in which the cis-1,4 and 1,2 vinyl contents, the viscosity η at 25° C. as a 5 wt % solution in toluene, and the relationship between the Mooney viscosity and the polydispersity index Mw/Mn have each been optimized.

That is, the polybutadiene (a) has a cis-1,4 content of at least 60%, preferably at least 80%, more preferably at least

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90%, and most preferably at least 95%; and has a 1,2 vinyl content of at most 2%, preferably at most 1.7%, more preferably at most 1.5%, and most preferably at most 1.3%. Outside of the above ranges, the resilience declines.

The polybutadiene (a) must also have a viscosity η at 25° C. as a 5 wt % solution in toluene of not more than 600 mPa·s. "Viscosity η at 25° C. as a 5 wt % solution in toluene" refers herein to the value in mPa·s units obtained by dissolving 2.28 g of the polybutadiene to be measured in 50 ml of toluene and carrying out measurement with a specified viscometer at 25° C. using a standard solution for the viscometer (JIS Z8809).

The polybutadiene (a) has a viscosity η at 25° C. as a 5 wt % solution in toluene of not more than 600 mPa·s, preferably not more than 550 mPa·s, more preferably not more than 500 mPa·s, even more preferably not more than 450 mPa·s, and most preferably not more than 400 mPa·s. Too high a viscosity η lowers the workability of the rubber composition. It is recommended that the viscosity η be at least 50 mPa·s, preferably at least 100 mPa·s, more preferably at least 150 mPa·s, and most preferably at least 200 mPa·s. Too low a viscosity η may lower the resilience.

In addition, the polybutadiene (a) must satisfy the relationship:

$$10B+5 \leq A \leq 10B+60,$$

wherein A is the Mooney viscosity (ML_{1+4} (100° C.)) of the polybutadiene and B is the ratio Mw/Mn between the weight-average molecular weight Mw and the number-average molecular weight Mn of the polybutadiene. A is preferably at least 10B+7, more preferably at least 10B+8 and most preferably at least 10B+9, but preferably not more than 10B+55, more preferably not more than 10B+50, and most preferably not more than 10B+45. If A is too low, the resilience declines. On the other hand, if A is too high, the workability of the rubber composition worsens.

It is recommended that the polybutadiene (a) have a Mooney viscosity (ML_{1+4} (100° C.)) of at least 20, preferably at least 30, more preferably at least 40, and most preferably at least 50, but not more than 80, preferably not more than 70, more preferably not more than 65, and most preferably not more than 60.

The term "Mooney viscosity" used herein refers in each case to an industrial index of viscosity as measured with a Mooney viscometer, which is a type of rotary plastometer (see JIS K6300). This value is represented by the symbol ML_{1+4} (100° C.), wherein "M" stands for Mooney viscosity, "L" stands for large rotor (L-type), "1+4" stands for a pre-heating time of 1 minute and a rotor rotation time of 4 minutes, and "100° C." indicates that measurement was carried out at a temperature of 100° C.

It is desirable for the polybutadiene (a) to be synthesized using a rare-earth catalyst. A known rare-earth catalyst may be used for this purpose.

Examples of suitable catalysts include lanthanide series rare-earth compounds, organoaluminum compounds, alumoxane, halogen-bearing compounds, optionally in combination with Lewis bases.

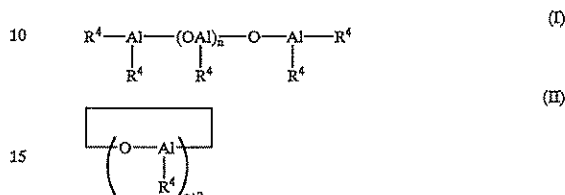
Examples of suitable lanthanide series rare-earth compounds include halides, carboxylates, alcoholates, thioalcoholates and amides of atomic number 57 to 71 metals.

Organoaluminum compounds that may be used include those of the formula $AlR^1R^2R^3$ (wherein R^1 , R^2 and R^3 are

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each independently a hydrogen or a hydrocarbon residue of 1 to 8 carbons).

Preferred alumoxanes include compounds of the structures shown in formulas (I) and (II) below. The alumoxane association complexes described in *Fine Chemical* 23, No. 9, 5 (1994), *J. Am. Chem. Soc.* 115, 4971 (1993), and *J. Am. Chem. Soc.* 117, 6465 (1995) are also acceptable.



In the above formulas, R^4 is a hydrocarbon group having 1 to 20 carbon atoms, and n is 2 or a larger integer.

Examples of halogen-bearing compounds that may be used include aluminum halides of the formula AlX_nR_{3-n} (wherein X is a halogen; R is a hydrocarbon residue of 1 to 20 carbons, such as an alkyl, aryl or aralkyl; and n is 1, 1.5, 2 or 3); strontium halides such as Me_3SrCl , Me_2SrCl_2 , $MeSrHCl_2$ and $MeSrCl_3$ (wherein "Me" stands for methyl); and other metal halides such as silicon tetrachloride, tin tetrachloride and titanium tetrachloride.

The Lewis base may be used to form a complex with the lanthanide series rare-earth compound. Illustrative examples include acetylacetone and ketone alcohols.

In the practice of the invention, the use of a neodymium catalyst composed in part of a neodymium compound as the lanthanide series rare-earth compound is advantageous because it enables a polybutadiene rubber having a high cis-1,4 content and a low 1,2 vinyl content to be obtained at an excellent polymerization activity. Preferred examples of such rare-earth catalysts include those mentioned in JP-A 11-35633.

The polymerization of butadiene in the presence of a rare-earth catalyst may be carried out by bulk polymerization or vapor phase polymerization, either with or without the use of solvent, and at a polymerization temperature in a range of generally -30° C. to +150° C., and preferably 10° C. to 100° C.

It is also possible for the polybutadiene (a) to be obtained by polymerization using the above-described rare-earth catalyst, followed by the reaction of an end group modifier with active end groups on the polymer.

Any known end group modifier may be used. Examples include compounds of types (1) to (6) described below:

- (1) halogenated organometallic compounds, halogenated metallic compounds and organometallic compounds of the general formulas $R^5_nM'X_{4-n}$, $M'X_4$, $M'X_3$, $R^5_nM'(-R^6-COOR^7)_{4-n}$ or $R^5_nM'(-R^6-COR^7)_{4-n}$ (wherein R^5 and R^6 are each independently a hydrocarbon group of 1 to 20 carbons; R^7 is a hydrocarbon group of 1 to 20 carbons which may contain a carbonyl or ester moiety as a side chain; M' is a tin atom, silicon atom, germanium atom or phosphorus atom; X is a halogen atom; and n is an integer from 0 to 3);
- (2) heterocumulene compounds containing on the molecule a $Y=C=Z$ linkage (wherein Y is a carbon atom, oxygen atom, nitrogen atom or sulfur atom; and Z is an oxygen atom, nitrogen atom or sulfur atom);

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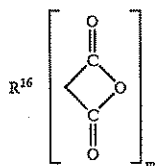
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- (3) three-membered heterocyclic compounds containing on the molecule the following bonds



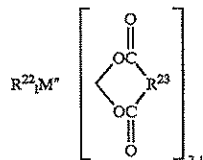
(wherein Y is an oxygen atom, a nitrogen atom or a sulfur atom);

- (4) halogenated isocyano compounds;
 (5) carboxylic acids, acid halides, ester compounds, carbonate compounds or acid anhydrides of the formulas $R^8-(COOH)_m$, $R^9(COX)_m$, $R^{10}-(COO-R^{11})_m$, $R^{12}-OCOO-R^{13}$, $R^{14}-(COOCO-R^{15})_m$ or the following formula



(wherein R^8 to R^{16} are each independently a hydrocarbon group of 1 to 50 carbons; X is a halogen atom; and m is an integer from 1 to 5); and

- (6) carboxylic acid metal salts of the formula $R^{17}_1M''(OCOR^{18})_{4-1}$, $R^{19}_1M''(OCO-R^{20}-COOR^{21})_{4-1}$ or the following formula



(wherein R^{17} to R^{23} are each independently a hydrocarbon group of 1 to 20 carbons, M'' is a tin atom, a silicon atom or a germanium atom; and 1 is an integer from 0 to 3).

Illustrative examples of the end group modifiers of types (1) to (6) above and methods for their reaction are described in, for instance, JP-A 11-35633 and JP-A 7-268132.

In the practice of the invention, component (a) is included in the base rubber in an amount of at least 20 wt %, preferably at least 25 wt %, more preferably at least 30 wt %, and most preferably at least 35 wt %. The upper limit is 100 wt %, preferably not more than 90 wt %, more preferably not more than 80 wt %, and most preferably not more than 70 wt %.

In addition to component (a), the base rubber may include also a diene rubber (b) insofar as the objects of the invention are attainable. Specific examples of the diene rubbers (b) include polybutadiene rubber, styrene-butadiene rubber (SBR), natural rubber, polyisoprene rubber, and ethylene-propylene-diene rubber (EPDM). Any one or combination of two or more thereof may be used.

The diene rubber (b) is included together with component (a) in the base rubber in an amount of at least 0 wt %, preferably at least 10 wt %, more preferably at least 20 wt %, and most preferably at least 30 wt %, but not more than 80 wt %, preferably not more than 75 wt %, more preferably not more than 70 wt %, and most preferably not more than 65 wt %.

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In the practice of the invention, it is preferable for component (b) to include a polybutadiene rubber, and especially one for which the cis-1,4 and 1,2 vinyl contents, the Mooney viscosity, and the relationship between the Mooney viscosity and η have each been optimized. The polybutadiene serving as component (b) is referred to as "second polybutadiene" in order to distinguish it from the polybutadiene serving as component (a).

It is recommended that the second polybutadiene in component (b) have a cis-1,4 content of at least 60%, preferably at least 80%, more preferably at least 90%, and most preferably at least 95%, and that it have a 1,2 vinyl content of at most 5%, preferably at most 4.5%, more preferably at most 4.0%, and most preferably at most 3.5%.

It is recommended that the second polybutadiene have a Mooney viscosity of at least 10, preferably at least 20, more preferably at least 25, and most preferably at least 30, but not more than 55, preferably not more than 50, and most preferably not more than 45.

In the practice of the invention, it is recommended that the second polybutadiene be one that has been synthesized using a Group VIII catalyst. Exemplary Group VIII catalysts include nickel catalysts and cobalt catalysts.

Examples of suitable nickel catalysts include single-component systems such as nickel-kieselguhr, binary systems such as Raney nickel/titanium tetrachloride, and ternary systems such as nickel compound/organometallic compound/boron trifluoride etherate. Exemplary nickel compounds include reduced nickel on a carrier, Raney nickel, nickel oxide, nickel carboxylate and organonickel complexes. Exemplary organometallic compounds include trialkylaluminum compounds such as triethylaluminum, tri-n-propylaluminum, triisobutylaluminum and tri-n-hexylaluminum; alkyl lithium compounds such as n-butyllithium, sec-butyllithium, tert-butyllithium and 1,4-dilithiobutane; and dialkylzinc compounds such as diethylzinc and dibutylzinc.

Examples of suitable cobalt catalysts include the following composed of cobalt or cobalt compounds: Raney cobalt, cobalt chloride, cobalt bromide, cobalt iodide, cobalt oxide, cobalt sulfate, cobalt carbonate, cobalt phosphate, cobalt phthalate, cobalt carbonyl, cobalt acetylacetonate, cobalt diethyldithiocarbamate, cobalt anilinium nitrite and cobalt dinitrosyl chloride. It is particularly advantageous to use the above in combination with a dialkylaluminum monochloride such as diethylaluminum monochloride or diisobutylaluminum monochloride; a trialkylaluminum such as triethylaluminum, tri-n-propylaluminum, triisobutylaluminum or tri-n-hexylaluminum; an alkyl aluminum sesquichloride such as ethylaluminum sesquichloride; or aluminum chloride.

Polymerization using the Group VIII catalysts described above, and especially a nickel or cobalt catalyst, can generally be carried out by a process in which the catalyst is continuously charged into the reactor together with the solvent and butadiene monomer, and the reaction conditions are suitably selected from a temperature range of 5 to 60° C. and a pressure range of atmospheric pressure to 70 plus atmospheres, so as to yield a product having the above-indicated Mooney viscosity.

It is also desirable for the second polybutadiene in component (b) to satisfy the relationship:

$$20A-750 \leq \eta \leq 20A-550$$

wherein η is the viscosity of the second polybutadiene at 25° C. as a 5 wt % solution in toluene and A is the Mooney viscosity (ML₁₊₄ (100° C.)) of the second polybutadiene.

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The viscosity η is preferably at least 20A-700, more preferably at least 20A-680, and most preferably at least 20A-650, but preferably not more than 20A-560, more preferably not more than 20A-580, and most preferably not more than 20A-590. The use of a polybutadiene having such an optimized relationship of η and A, that suggests the high linearity of polybutadiene molecules, is effective for conferring better resilience and workability.

The second polybutadiene generally accounts for at least 30 wt %, preferably at least 50 wt %, and most preferably at least 70 wt %, and up to 100 wt %, preferably up to 90 wt %, and most preferably up to 80 wt %, of the diene rubber (b). By including the second polybutadiene within component (b) in the foregoing range, even better extrudability and hence, workability during manufacture can be conferred.

The solid core in the golf balls of the invention is molded from a rubber composition containing as essential components specific amounts of (c) an unsaturated carboxylic acid and/or metal salt thereof, (d) an organosulfur compound, (e) an inorganic filler and (f) an organic peroxide per 100 parts by weight of the base rubber.

Specific examples of unsaturated carboxylic acids that may be used as component (c) include acrylic acid, methacrylic acid, maleic acid and fumaric acid. Acrylic acid and methacrylic acid are especially preferred.

Specific examples of unsaturated carboxylic acid metal salts that may be used as component (c) include the zinc and magnesium salts of unsaturated fatty acids such as zinc methacrylate and zinc acrylate. Zinc acrylate is especially preferred.

The unsaturated carboxylic acid and/or metal salt thereof used as component (c) is included in an amount, per 100 parts by weight of the base rubber, of at least 10 parts by weight, preferably at least 15 parts by weight, and most preferably at least 20 parts by weight, but not more than 60 parts by weight, preferably not more than 50 parts by weight, more preferably not more than 45 parts by weight, and most preferably not more than 40 parts by weight. Too much component (c) results in excessive hardness, giving the golf ball a feel upon impact that is difficult for the player to endure. On the other hand, too little component (c) undesirably lowers the resilience.

The organosulfur compound (d) of the rubber composition is essential for imparting good resilience. Exemplary organosulfur compounds include thiophenol, thionaphthol, halogenated thiophenols, and metal salts thereof. Specific examples include pentachlorothiophenol, pentafluorothiophenol, pentabromothiophenol, p-chlorothiophenol, and zinc salts thereof, such as the zinc salt of pentachlorothiophenol; and organosulfur compounds having 2 to 4 sulfurs, such as diphenylpolysulfides, dibenzylpolysulfides, dibenzoylpolysulfides, dibenzothiazoylpolysulfides and dithiobenzoylpolysulfides. Diphenyldisulfide and the zinc salt of pentachlorothiophenol are especially preferred.

The organosulfur compound (d) is included in an amount, per 100 parts by weight of the base rubber, of at least 0.1 part by weight, preferably at least 0.2 part by weight, and most preferably at least 0.5 part by weight, but not more than 5 parts by weight, preferably not more than 4 parts by weight, more preferably not more than 3 parts by weight, and most preferably not more than 2 parts by weight. Too much organosulfur compound results in an excessively low hardness, whereas too little makes it impossible to enhance the resilience.

Examples of inorganic fillers that may be used as component (e) include zinc oxide, barium sulfate and calcium

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carbonate. The inorganic filler (e) is included in an amount, per 100 parts by weight of the base rubber, of at least 5 parts by weight, preferably at least 7 parts by weight, more preferably at least 10 parts by weight, and most preferably at least 13 parts by weight, but not more than 80 parts by weight, preferably not more than 50 parts by weight, more preferably not more than 45 parts by weight, and most preferably not more than 40 parts by weight. Too much or too little inorganic filler makes it impossible to achieve a golf ball core having an appropriate weight and good rebound characteristics.

The organic peroxide (f) may be a commercial product, suitable examples of which include Percumil D (manufactured by NOF Corporation), Perhexa 3M (manufactured by NOF Corporation) and Luperco 231XL (manufactured by Atochem Co.). If necessary, two or more different organic peroxides may be mixed and used together.

The organic peroxide (f) is included in an amount, per 100 parts by weight of the base rubber, of at least 0.1 part by weight, preferably at least 0.3 part by weight, more preferably at least 0.5 part by weight, and most preferably at least 0.7 part by weight, but not more than 5 parts by weight, preferably not more than 4 parts by weight, more preferably not more than 3 parts by weight, and most preferably not more than 2 parts by weight. Too much or too little organic peroxide makes it impossible to achieve a ball having a good feel upon impact and good durability and rebound characteristics.

If necessary, the rubber composition may also include an antioxidant, suitable examples of which include such commercial products as Nocrac NS-6, Nocrac NS-30 (both made by Ouchi Shinko Chemical Industry Co., Ltd.), and Yoshinox 425 (made by Yoshitomi Pharmaceutical Industries, Ltd.). The use of such an antioxidant in an amount, per 100 parts by weight of the base rubber, of at least 0 part by weight, preferably at least 0.05 part by weight, more preferably at least 0.1 part by weight, and most preferably at least 0.2 part by weight, but not more than 3 parts by weight, preferably not more than 2 parts by weight, more preferably not more than 1 part by weight, and most preferably not more than 0.5 part by weight, is desirable for achieving good rebound characteristics and durability.

The solid core of the invention can be produced by vulcanizing and curing the above-described rubber composition using a method like that employed with known rubber compositions for golf balls. For example, vulcanization may be carried out at a temperature of 100 to 200° C. for a period of 10 to 40 minutes.

In the practice of the invention, the solid core has a hardness which is suitably adjusted according to its manner of use in the various golf ball constructions that may be employed and is not subject to any particular limitation. The core may have a cross-sectional hardness profile which is flat from the center to the surface thereof, or which varies from the center to the surface.

It is recommended that the solid core have a deflection, when subjected to a load of 980 N (100 kg), of at least 2.0 mm, preferably at least 2.5 mm, more preferably at least 2.8 mm, and most preferably at least 3.2 mm, but not more than 6.0 mm, preferably not more than 5.5 mm, more preferably not more than 5.0 mm, and most preferably not more than 4.5 mm. Too small a deformation may worsen the feel of the ball upon impact and, particularly on long shots such as with a driver in which the ball incurs a large deformation, may subject the ball to an excessive rise in spin, reducing the carry. On the other hand, if the solid core is too soft, the golf ball tends to have a dead feel when hit, an inadequate

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rebound that results in a poor carry, and a poor durability to cracking with repeated impact.

It is recommended that the solid core in the inventive golf ball have a diameter of at least 30.0 mm, preferably at least 32.0 mm, more preferably at least 34.0 mm, and most preferably at least 35.0 mm, but not more than 40.0 mm, preferably not more than 39.5 mm, and most preferably not more than 39.0 mm.

It is also recommended that the solid core have a specific gravity of at least 0.9, preferably at least 1.0, and most preferably at least 1.1, but not more than 1.4, preferably not more than 1.3, and most preferably not more than 1.2.

The golf ball of the invention is a multi-piece solid golf ball having a cover composed of at least two layers which are referred to herein as the "inner cover layer" and the "outer cover layer." Such cover layers can be produced from known cover stock. The cover stocks used to make both cover layers in the inventive golf ball may be composed primarily of a thermoplastic or thermoset polyurethane elastomer, polyester elastomer, ionomer resin, ionomer resin having a relatively high degree of neutralization, polyolefin elastomer or mixture thereof. Any one or mixture of two or more thereof may be used, although the use of a thermoplastic polyurethane elastomer, ionomer resin or ionomer resin having a relatively high degree of neutralization is especially preferred.

Illustrative examples of thermoplastic polyurethane elastomers that may be used for the above purpose include commercial products in which the diisocyanate is an aliphatic or aromatic compound, such as Pandex T7298, Pandex T7295, Pandex T7890, Pandex TR3080, Pandex T8290, Pandex T8295 and Pandex T1188 (all manufactured by DIC Bayer Polymer, Ltd.). Illustrative examples of suitable commercial ionomer resins include Surlin 6320, Surlin 8945, Surlin 9945 and Surlin 8120 (both products of E. I. du Pont de Nemours and Co., Inc.), and Himilan 1706, Himilan 1605, Himilan 1855, Himilan 1557, Himilan 1601 and Himilan AM7316 (all products of DuPont-Mitsui Polychemicals Co., Ltd.).

Together with the primary material described above, the cover stock may include also, as an optional material, polymers (e.g., thermoplastic elastomers) other than the foregoing. Specific examples of polymers that may be included as optional constituents include polyamide elastomers, styrene block elastomers, hydrogenated polybutadienes and ethylene-vinyl acetate (EVA) copolymers.

The multi-piece solid golf ball of the invention can be manufactured by any suitable known method without particular limitation. In one preferred method, the solid core is placed within a given injection mold, following which a predetermined method is used to successively inject over the core the above-described inner and outer cover layer materials. In another preferred method, each of the cover stocks is formed into a pair of half cups, and the resulting pairs are successively placed over the solid core and compression molded.

In the golf balls of the invention, it is critical that the outer cover layer have a lower Shore D hardness than the inner cover layer.

It is recommended that the inner cover layer have a Shore D hardness of at least 50, preferably at least 51, more preferably at least 52, and most preferably at least 53, but not more than 80, preferably not more than 75, more preferably not more than 70, and most preferably not more than 65.

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It is recommended that the outer cover layer have a Shore D hardness of at least 35, preferably at least 40, more preferably at least 45, and most preferably at least 48, but not more than 60, preferably not more than 58, more preferably not more than 56, and most preferably not more than 54.

As noted above, in the practice of the invention the outer cover layer must have a lower Shore D hardness than the inner cover layer. It is advantageous for the inner and outer cover layers to have a difference in Shore D hardness of at least 2, preferably at least 5, more preferably at least 7, and most preferably at least 9 Shore D hardness units, but not more than 30, preferably not more than 25, and most preferably not more than 20 Shore D hardness units.

It is recommended that the inner and outer cover layers have a respective thickness of at least 0.7 mm, and preferably at least 1.0 mm, but not more than 3.0 mm, preferably not more than 2.5 mm, even more preferably not more than 2.0 mm, and most preferably not more than 1.6 mm.

The multi-piece solid golf ball of the invention can be manufactured for competitive use by imparting the ball with a diameter and weight which conform with the Rules of Golf; that is, a diameter of at least 42.67 mm and a weight of not more than 45.93 g. It is recommended that the diameter be no more than 44.0 mm, preferably no more than 43.5 mm, and most preferably no more than 43.0 mm; and that the weight be at least 44.5 g, preferably at least 45.0 g, more preferably at least 45.1 g, and most preferably at least 45.2 g.

Multi-piece solid golf balls according to the present invention have a good, soft feel upon impact and an excellent spin performance that enable the ball to travel a greater distance when played.

EXAMPLES

The following examples and comparative examples are provided to illustrate the invention, and are not intended to limit the scope thereof.

Examples 1-5 & Comparative Examples 1-4

The core materials shown in Table 2 were formulated in the indicated amounts per 100 parts by weight of polybutadiene material composed of polybutadiene types (1) to (7) below in the proportions shown in Table 1. The resulting core formulations were blended in a kneader or on a roll mill, then molded under applied pressure at 150° C. for 20 minutes to form solid cores having a diameter of about 36.4 mm.

Types of Polybutadiene

- (1) BR01, made by JSR Corporation
- (2) BR11, made by JSR Corporation
- (3) UBE101, made by Ube Industries, Ltd.
- (4) HCBN-4, an experimental grade of polybutadiene made by JSR Corporation
- (5) HCBN-2, an experimental grade of polybutadiene made by JSR Corporation
- (6) Experimental grade #9100081 made by Firestone
- (7) Experimental grade #9100069 made by Firestone

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TABLE 1

Type	Catalyst	cis-1,4 content, %	1,2 vinyl content, %	Mooney viscosity (A)	Mw/Mn (B)	η	10B + 5	10B + 60	20A - 550
Polybutadiene									
(1)	Ni	96	2.5	44	4.2	150	47	102	330
(2)	Ni	96	2	44	4.4	270	49	104	330
(3)	Co	95	3	38	4.2	130	47	102	210
(4)	Nd	96	1.1	44	3.5	390	40	95	330
(5)	Nd	96	0.9	40	3.3	280	38	93	250
(6)	Nd	95	1.5	56	2.6	370	31	86	570
(7)	Nd	96	1.3	48	2.5	280	30	85	410

TABLE 2

	Example					Comparative Example			
	1	2	3	4	5	1	2	3	4
Rubber formulation (pbw)									
(1)						50			
(2)	70	30	50		50	50	50		
(3)				50			50		50
(4)	30								
(5)				50	50		50	50	50
(6)		70							
(7)			50						
Core formulation (pbw)									
Polybutadiene	100	100	100	100	100	100	100	100	100
Dicumyl peroxide	1.4	1.4	1.4	0.7	0.7	1.4	1.4	1.4	1.4
1,1-Bis(t-butylperoxy)-3,3,5-trimethylcyclohexane				0.3	0.3				
Zinc oxide	18	18	15.5	27	26	26	28.5	27	26
Antioxidant	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Zinc acrylate	27	27	31	30	32	32	28	30	32
Zinc salt of pentachlorothiophenol	1	1	2	1	1	1	0	1	1

The resulting solid cores were tested as described below to determine their deformation under 980 N (100 kg) loading and their rebound. The results are shown in Table 4.

Deformation Under 980 N Loading

Measured as the deflection (mm) of the solid core when subjected to a load of 980 N (100 kg).

Rebound

The initial velocity of the solid cores was measured with the same type of initial velocity instrument as used by the official regulating body—the United States Golf Association (USGA). Each rebound value shown in Table 4 is the difference between the initial velocity of the solid core obtained in that particular example and the initial velocity of the solid core obtained in Comparative Example 2.

In each example, the resulting solid core was placed in a given mold and the appropriate resin shown in Table 3 was injection-molded over the core, thereby producing an inner layer-covered core having a diameter of about 39.7 mm. The covered core was then transferred to a given mold, and the appropriate resin shown in Table 3 was injection molded over the covered core, yielding a three-piece solid golf ball having a diameter of about 42.7 mm and a weight of about 45.3 g. Trade names appearing in Table 3 are described below.

Himilan: An ionomer resin produced by DuPont-Mitsui Polychemicals Co., Ltd.

Surlyn: An ionomer resin produced by E. I. du Pont de Nemours and Co.

Dynaron: An E-EB-E block copolymer produced by JSR Corporation

Pandex: A polyurethane elastomer produced by Bayer-DIC Polymer, Ltd.

The properties of the resulting golf balls were determined as described below. The results are shown in Table 4.

Material Properties

The Shore D hardnesses of the inner cover layer and the outer cover layer were measured with a durometer by the test method described in ASTM D2240.

Golf Ball Properties

The carry and total distance were measured when the ball was hit at a head speed (HS) of 50 m/s with a driver (No. 1 Wood) mounted on a swing machine.

Feel

The feel of the ball when actually shot with a driver (No. 1 Wood) and putter was rated by five professional and five top-caliber amateur golfers as "Too hard," "Good" or "Too soft." The rating assigned most often to a particular ball was used as that ball's overall rating.

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TABLE 3

	A	B	C	D	E	F	G
Formulation (pbw)							
Himilan 1706	50	70					
Himilan 1605	50						
Himilan 1557							20
Himilan 1855							30
Himilan AM7316		12					
Suriya 8945			35				
Suriya 9945			35				
Suriya 8120				100			50
Dynaron 6100P			30				15
Pandex T8290					50		
Pandex T8295					50	100	
Behenic acid		16					
Magnesium oxide		2					
Titanium dioxide	4	2	4	4	2.7	2.7	4
							20

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Japanese patent application Ser. No. 2001-163238 is incorporated herein by reference.

Although some preferred embodiments have been described, many modifications and variations may be made thereto in light of the above teachings. It is therefore to be understood that the invention may be practiced otherwise than as specifically described without departing from the scope of the appended claims.

What is claimed is:

1. A multi-piece solid golf ball comprising a solid core, an inner cover layer and an outer cover layer, wherein the solid core is molded from a rubber composition comprising

100 parts by weight of a base rubber composed of (a) 20 to 100 wt % of a polybutadiene having a cis-1,4 content of at least 60% and a 1,2 vinyl content of at most 2%, having a viscosity η at 25° C. as a 5 wt % solution in toluene of up to 600 mPa-s, being synthesized using a rare-earth catalyst and satisfying the relationship: $10B+5 \leq A \leq 10B+60$, wherein A is the Mooney viscosity (ML_{1+4} (100° C.)) of the polybutadiene and B is the ratio M_w/M_n between the weight-average molecular weight M_w and the number-average molecular weight M_n of the polybutadiene, in combination with (b) 0 to 80 wt % of a diene rubber other than component (a),

TABLE 4

	Example					Comparative Example			
	1	2	3	4	5	1	2	3	4
Core properties									
Deflection (mm) under 980 N load	3.8	3.8	3.5	3.5	3.3	3.3	3.5	3.5	3.3
Specific gravity	1.15	1.15	1.15	1.21	1.21	1.21	1.21	1.21	1.21
Rebound (m/s)	+0.9	+0.9	+1.1	+0.7	+0.8	+0.3	0	+0.5	+0.5
Inner cover layer									
Type	A	B	C	A	B	B	A	D	D
Shore D hardness	63	60	56	63	60	60	63	45	45
Specific gravity	0.98	0.97	0.97	0.98	0.97	0.97	0.98	0.98	0.98
Thickness (mm)	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Outer cover layer									
Type	E	F	F	G	G	G	G	G	A
Shore D hardness	47	51	51	53	53	53	53	53	63
Specific gravity	1.18	1.18	1.18	0.98	0.98	0.98	0.98	0.98	0.98
Thickness (mm)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Golf ball properties									
When hit with No. 1 Wood at HS of 50 m/s									
Carry (m)	227.0	226.9	226.7	226.9	226.7	223.8	222.2	217.7	220.8
Total distance (m)	258.5	258.8	258.3	258.3	258.0	255.0	253.4	248.3	252.8
Spin rate (rpm)	3205	3153	3241	3125	3180	3182	3121	3305	3177
Feel on impact	good	good	good	good	good	good	good	too soft	good
Spin rate on approach shot (sand wedge; HS 20 m/s)	6323	6251	6226	6118	6111	6107	6113	6186	4308
Feel of ball	good	good	good	good	good	good	good	too soft	too hard

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(c) 10 to 60 parts by weight of an unsaturated carboxylic acid or a metal salt thereof or both,
 (d) 0.1 to 5 parts by weight of an organosulfur compound,
 (e) 5 to 80 parts by weight of an inorganic filler,
 (f) 0.1 to 5 parts by weight of an organic peroxide;
 the inner cover layer has a Shore D hardness of 50 to 80;
 the outer cover layer has a Shore D hardness of 35 to 60;
 and
 the outer cover layer has a lower Shore D hardness than the inner cover layer.
 2. The golf ball of claim 1, wherein the diene rubber (b) includes 30 to 100 wt % of a second polybutadiene which has a cis-1,4 content of at least 60% and a 1,2 vinyl content of at most 5%, has a Mooney viscosity (ML_{1+4} (100° C.)) of not more than 55, and satisfies the relationship:
 $\eta \leq 20A - 550$,
 wherein A is the Mooney viscosity (ML_{1+4} (100° C.)) of the second polybutadiene and η is the viscosity of the second polybutadiene, in mPa·s, at 25° C. as a 5 wt % solution in toluene.

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3. The golf ball of claim 1 wherein said polybutadiene (a) is synthesized by using neodymium catalyst.
 4. The golf ball of claim 1 wherein said polybutadiene (a) has a Mooney viscosity (ML_{1+4} , 100° C.) of 40 to 60.
 5. The golf ball of claim 1, wherein the outer cover layer and the inner cover layer have a difference in Shore D hardness of at least 5 units.
 6. The golf ball of claim 1, wherein the outer cover layer and the inner cover layer have a difference in Shore D hardness of at least 7 units.
 7. The golf ball of claim 1, wherein the outer cover layer and the inner cover layer have a difference in Shore D hardness of at least 9 units.
 8. The golf ball of claim 1, wherein said ball is three-piece construction consisting of a solid core, an inner cover layer and an outer cover layer.
 9. The golf ball of claim 2, wherein the second polybutadiene in component (b) is synthesized using a Group VIII catalyst.

* * * * *

EXHIBIT 2



US005252652A

United States Patent [19]

Egashira et al.

[11] Patent Number: **5,252,652**[45] Date of Patent: **Oct. 12, 1993**[54] **SOLID GOLF BALL**

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[21] Appl. No.: 521,618

[22] Filed: May 10, 1990

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A63B 37/00

[52] U.S. Cl. 524/392; 524/289;
524/382; 524/908; 273/218

[58] Field of Search 524/908, 289, 382, 392

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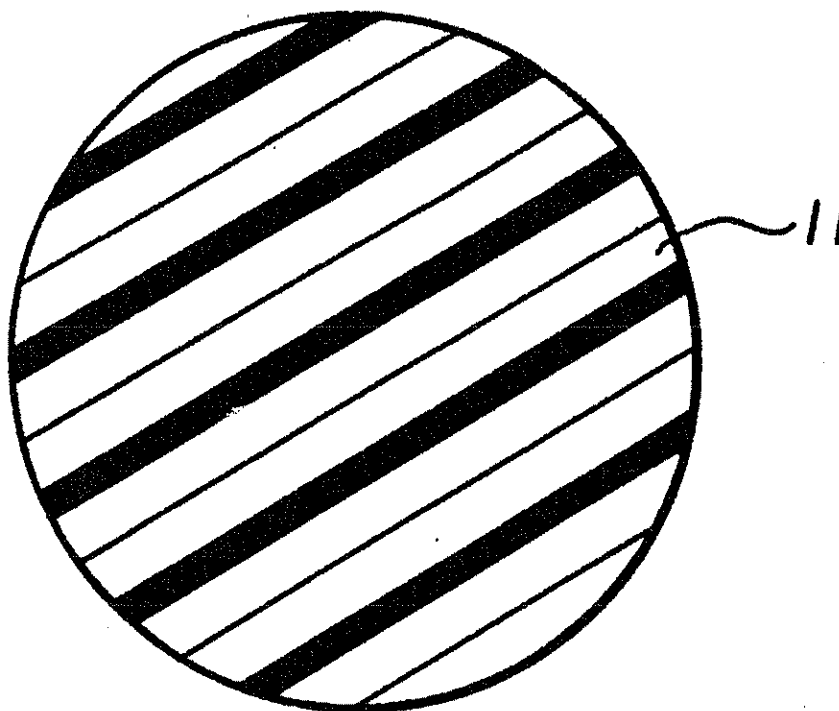
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Macpeak & Seas

[57] **ABSTRACT**

One-piece and multi-layered golf balls are improved in flying performance by forming the one-piece ball entirely or multi-layered golf ball core from a rubber composition comprising a base rubber, an unsaturated carboxylic acid metal salt, and an organic sulfur compound and/or a metal salt thereof.

13 Claims, 1 Drawing Sheet



U.S. Patent

Oct. 12, 1993

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FIG. 1

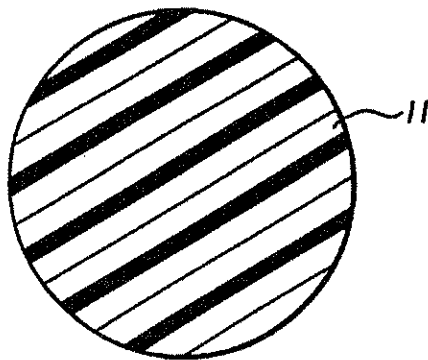
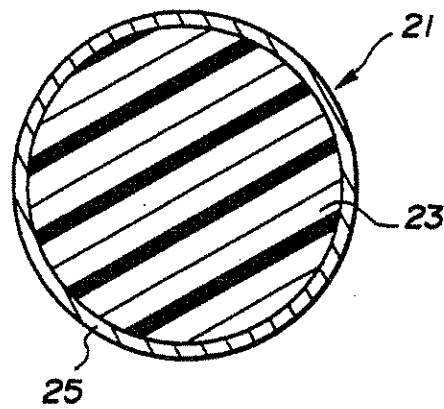


FIG. 2



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SOLID GOLF BALL

This invention relates to solid golf balls having improved flying performance.

BACKGROUND OF THE INVENTION

In general, solid golf balls include a one-piece golf ball which is integrally molded in its entirety a two-piece golf ball having a core enclosed in a cover, and a multi-layered golf ball having a core enclosed in a cover through one or more intermediate layers.

These solid golf balls have an elastic portion in the form of a molded and vulcanized rubber compound as a portion, that is, a core in the case of multi-layered golf balls or as their entirety in the case of one-piece golf balls. For the purpose of improving the repulsion coefficient and impact resistance of the prior art rubber compositions from which the elastic portion was formed, attempts were made to blend a monomer having an unsaturated bond, typically an α,β -ethylenically unsaturated carboxylic acid metal salt as a co-crosslinking agent in polybutadiene or a similar base rubber. The co-crosslinking agent will graft or crosslink to the backbone of polybutadiene rubber under the action of a peroxide or similar co crosslinking initiator, resulting in a three-dimensional crosslinked polymer, which can provide an adequate degree of hardness and durability for one-piece golf balls or multi-layered golf ball cores. Therefore, one-piece golf balls formed from rubber compositions having such a co-crosslinking agent blended and multi-layered golf balls having cores formed from rubber compositions having such a co-crosslinking agent blended are known to exhibit satisfactory flying performance and durability.

Golf players have a continuous demand for better flying performance and it is thus desired to develop golf balls having further improved flying performance.

SUMMARY OF THE INVENTION

Therefore, an object of the invention is to provide a golf ball having further improved flying performance.

Searching for an optimum additive for a rubber composition containing a base rubber, typically polybutadiene and an unsaturated carboxylic acid metal salt as a co-crosslinking agent, the inventors have found that when an organic sulfur compound and/or a metal-containing organic sulfur compound is added to the rubber composition, there is obtained a rubber composition which can be vulcanized into a rubbery elastomer having improved rebound resilience. If a one piece golf ball or a multi-layered golf ball core is formed from this rubber composition, the resulting solid golf ball exhibits an increased initial velocity upon hitting and improved flying performance. The present invention is predicated on this finding.

According to the present invention, there is provided a solid golf ball comprising a rubber composition containing a base rubber, an unsaturated carboxylic acid metal salt, and a sulfur compound selected from the group consisting of an organic sulfur compound and a metal-containing organic sulfur compound.

In one form, the ball is a one-piece golf ball which is entirely formed of the present rubber composition.

In another form, the ball is a multi-layered golf ball comprising a core and a cover enclosing the core, wherein the core is formed of the present rubber com-

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position. The core may be enclosed in the cover directly or through an intermediate layer.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross section of a one-piece golf ball.

FIG. 2 is a cross section of a two-piece golf ball.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows in cross section a one-piece golf ball 11. FIG. 2 shows a two-piece golf ball 21 comprising a core 23 coated with a cover 25. A plurality of, usually 200 to 600, dimples are formed on the surface of the golf balls, although they are not shown in FIGS. 1 and 2.

The solid golf ball of the present invention is a one piece golf ball or a multi-layered golf ball in which the one-piece golf ball or the core of the multi-layered golf ball is formed from a rubber composition comprising a base rubber, an unsaturated carboxylic acid metal salt, and an organic sulfur compound and/or a metal-containing organic sulfur compound.

The base rubber used herein may be any desired rubber which is commonly used in conventional one-piece golf balls and cores of multi-layered golf balls. Polybutadiene rubbers, especially poly(1,4-butadiene) rubbers containing at least 40 mol %, preferably 80 to 100 mol % of cis-1,4 bond are preferred because of high rebound resilience, extrusion moldability, and high strength after vulcanization. If desired, the poly(1,4-butadiene) rubbers may be blended with natural rubber, polyisoprene rubber, styrene-butadiene rubber or the like. It is desired that at least 80% by weight of poly(1,4-butadiene) rubber be present in the base rubber because base rubbers containing less amounts of poly(1,4-butadiene) rubber often fail to take advantage of the rebound resilience of polybutadiene rubber.

The metal salt of unsaturated carboxylic acid is blended as a co-crosslinking agent. Examples include zinc and magnesium salts of unsaturated fatty acids having 3 to 8 carbon atoms, such as acrylic acid, methacrylic acid, maleic acid, and fumaric acid, with the zinc salts of acrylic and methacrylic acid being most preferred. The unsaturated carboxylic acid metal salt may be blended in a rubber either as a preformed metal salt or by introducing an α,β -unsaturated carboxylic acid and a metal oxide or hydroxide into the rubber composition and allowing them to react in the rubber composition to form a metal salt. The unsaturated carboxylic acid metal salt may be blended in any desired amount, but preferably in amounts of about 25 to about 40 parts by weight per 100 parts by weight of the base rubber.

The rubber composition used in the manufacture of the solid golf ball of the invention contains an organic sulfur compound and/or a metal-containing organic sulfur compound in addition to the base rubber and the unsaturated carboxylic acid metal salt. Examples of the organic sulfur compound include thiophenols such as pentachlorothiophenol, 4-butyl-o-thiocresol, 4 t-butyl-p-thiocresol, and 2-benzamidothiophenol, thiocarboxylic acids such as thio-benzoic acid, and sulfides such as dixylyl disulfide, di(o-benzamidophenyl) disulfide and alkylated phenol sulfides. Examples of the metal-containing organic sulfur compound include zinc salts of the above-mentioned thiophenols and thiocarboxylic acids. The sulfur compounds may be used alone or in admixture of two or more of them. The sulfur compound is preferably blended in amounts of from about 0.05 to about 2 parts by weight, more preferably from

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about 0.1 to about 0.5 parts by weight per 100 parts by weight of the base rubber.

The rubber composition of the invention may further contain a co-crosslinking initiator. Preferred examples of the co-crosslinking initiator include organic peroxides, such as dicumyl peroxide, t-butylperoxybenzoate, di-t-butylperoxide, 1,1-bis(t-butylperoxy)-3,3,5-trimethyl-cyclohexane, n-butyl-4,4-bis(t-butylperoxy)valerate, 2,2-bis(t-butylperoxy-isopropyl)benzene, and 2,5-dimethyl-2,5-di(t-butylperoxy)hexene, with the dicumyl peroxide being most preferred. The initiator may be blended in amounts of about 0.5 to about 3 parts by weight, preferably about 1 to about 2.5 parts by weight per 100 parts by weight of the base rubber.

Also employable is a filler. Preferred examples of the filler include metal oxides such as zinc oxide and magnesium oxide. It may be blended in amounts of about 10 to about 80 parts by weight per 100 parts by weight of the base rubber. If desired, the rubber composition can additionally contain a plasticizer, an antioxidant, and any other additives which are generally employed in the preparation of one-piece balls or cores of multi-layered balls. Their amounts may be determined without undue experimentation.

The solid golf ball of the invention may be prepared by molding the above-formulated rubber composition as formulated above into a desired spherical shape, that is, a ball in the case of a one-piece ball or into a core in the case of a multi-layered ball and vulcanizing the rubber by heating. The manufacture may be in accord with conventional method and conditions.

When multi-layered golf balls such as two-piece balls are manufactured, the core is coated with a cover. The cover material used herein may be selected from commonly used cover materials, for example, ionomers such as Surlyn®, polyesters, and nylons. The cover usually has a thickness of 0.5 to 2.5 mm.

The core may be enclosed in the cover directly or through an intermediate layer.

The present invention may be applied to any type of golf ball including small balls having a diameter of at least 41.15 mm and a weight of up to 45.92 g, and large balls having a diameter of at least 42.67 mm and a weight of up to 45.92 g.

The distribution and total number of dimples are not critical although 300 to 550 dimples, preferably 350 to 540 dimples are generally formed on a ball. Preferred dimple arrangements are regular icosahedral, regular dodecahedral, and regular octahedral arrangements. The dimples is preferably distributed uniformly on the ball surface in such an arrangement.

The solid golf balls of the invention are of the above-mentioned construction and exhibit excellent flying performance.

EXAMPLE

Examples of the invention are given below together with comparative examples by way of illustration and not by way of limitation.

EXAMPLES 1-6

Solid cores for two-piece golf balls were prepared and compared with conventional two-piece golf ball cores.

Six rubber compositions were prepared by mixing the ingredients shown in Table 1. A two-piece golf ball-forming solid core having a diameter of 38.0 mm was prepared by molding each of the compositions in a mold

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followed by vulcanization at 155° C. for 20 minutes. The cores were examined by a hitting test according to the USGA standard. Using a hitting machine of the flywheel type, the cores were hit at a head speed of 38 m/sec. to measure the initial velocity (in m/sec.). The results are shown in Table 1.

TABLE 1

	Core No.					
	1	2	3	4*	5*	6*
<u>Ingredients (pbw)</u>						
Poly(cis-1,4-butadiene)	100	90	80	100	90	80
Poly(cis-isoprene)	0	10	20	0	10	20
Zinc acrylate	32	32	32	32	32	32
Zinc oxide	21	21	21	21	21	21
Antioxidant	0.2	0.2	0.2	0.2	0.2	0.2
Dicumyl peroxide	1.5	1.5	1.5	1.5	1.5	1.5
Pentachlorothiophenol	0.2	0.2	0.2	0	0	0
zinc salt						
Initial velocity, m/sec.	73.32	73.11	72.80	72.95	72.67	72.30

*outside the scope of the invention

As seen from Table 1, the performance, that is, initial velocity upon hitting of the core is improved by blending zinc salt of pentachlorothiophenol which is a metal salt of an organic sulfur compound in a rubber composition.

Examples 7 and 8

Two rubber compositions were prepared by blending the ingredients shown in Table 2. Two-piece golf ball solid cores having a diameter of 38 mm were prepared by molding the composition in a mold and vulcanizing at 155° C. for 20 minutes. An ionomer resin composition was applied to the cores to form a cover thereon. There were obtained two-piece golf balls having a diameter of 42.7 mm.

The balls were measured for weight, hardness and initial velocity. The hardness of the balls was measured as a deflection (in mm) under a load of 100 kg. The initial velocity (in m/sec.) of the balls was measured by a hitting test according to the USGA standard in which the balls were hit at a head speed of 38 m/sec. using a hitting machine of the flywheel type. The results are shown in Table 2.

TABLE 2

	Example	
	7	8*
<u>Core composition (pbw)</u>		
Poly(cis-1,4-butadiene) rubber	100	100
Zinc acrylate	32	32
Zinc oxide	21	21
Antioxidant	0.2	0.2
Dicumyl peroxide	1.5	1.5
Pentachlorothiophenol zinc salt	0.2	—
<u>Ball properties</u>		
Weight, g	45.3	45.3
Hardness	2.30	2.32
Initial velocity, m/sec.	73.37	72.84

*outside the scope of the invention

As seen from Table 1, the golf balls of the invention are improved in initial velocity upon hitting and hence, in flying performance.

Although some preferred embodiments have been described, many modifications and variations may be made thereto in the light of the above teachings. It is therefore to be understood that within the scope of the

5,252,652

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appended claims, the invention may be practices otherwise than as specifically described.

We claim:

1. A solid golf ball, having an improved rebound property and initial velocity, comprising a rubber composition containing 100 parts by weight of a base rubber selected from the group consisting of polybutadiene rubber, natural rubber, polyisoprene rubber and styrene-butadiene rubber, about 25 to about 40 parts by weight of a zinc or magnesium salt of an unsaturated fatty acid having 3 to 8 carbon atoms, about 0.05 to about 2 parts by weight of a sulfur compound selected from the group consisting of pentachlorothiophenol, 4-t-butyl-o-thiocresol, 4-t-butyl-p-thiocresol, 2-benzamidothiophenol, thiobenzoic acid, and zinc salts thereof, and about 0.5 to about 3 parts by weight of an organic peroxide.

2. The solid golf ball of claim 1, wherein said solid golf ball is a one-piece golf ball which is formed of said rubber composition.

3. The solid gold ball of claim 1, wherein said solid golf ball core and a cover enclosing the core, and said core is formed of said rubber composition.

4. The solid golf ball of claim 3, wherein said solid golf ball is a two-piece ball, and said core is directly enclosed in the cover.

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5. The solid gold ball of claim 3, wherein said solid golf ball further comprises an intermediate layer between the core and the cover.

6. The solid golf ball of claim 1, wherein said base rubber is a polybutadiene rubber.

7. The solid gold ball of claim 6, wherein said polybutadiene rubber is a poly(1,4-butadiene) rubber containing at least 40 mol % of cis-1,4 bond.

8. The solid golf ball of claim 7, wherein said poly(1,4-butadiene) rubber contains at least 80 to 100 mol % of cis-1,4 bond.

9. The solid golf ball of claim 7, wherein said base rubber comprises at least 80% by weight of said poly(1,4-butadiene) rubber.

10. The solid golf ball of claim 9, wherein said poly(1,4-butadiene) rubber is blended with a natural rubber, a polyisoprene rubber of a styrene-butadiene rubber.

11. The solid gold ball of claim 1, wherein said sulfur compound is blended in an amount of from about 0.1 to about 0.5 parts by weight.

12. The solid golf ball of claim 1, wherein said organic peroxide is selected from the group consisting of dicumyl peroxide, t-butylperoxybenzoate, di-t-butylperoxide, 1,1-bis(t-butylperoxy)-3,3,5-trimethylcyclohexane, n-butyl-4,4-bis(t-butylperoxy)valerate, 2,2'-bis(t-butylperoxyisopropyl)benzene, and 2,5-dimethyl-2,5-di(t-butylperoxy)hexene.

13. The solid golf ball of claim 1, wherein said rubber composition further comprises a filler.

* * * * *

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EXHIBIT 3

**THIS EXHIBIT HAS BEEN
REDACTED IN ITS ENTIRETY**

EXHIBIT 4

**THIS EXHIBIT HAS BEEN
REDACTED IN ITS ENTIRETY**

EXHIBIT 5

**THIS EXHIBIT HAS BEEN
REDACTED IN ITS ENTIRETY**

EXHIBIT 6

**THIS EXHIBIT HAS BEEN
REDACTED IN ITS ENTIRETY**

EXHIBIT 7

**THIS EXHIBIT HAS BEEN
REDACTED IN ITS ENTIRETY**

EXHIBIT 8

**THIS EXHIBIT HAS BEEN
REDACTED IN ITS ENTIRETY**

EXHIBIT 9

LEXSEE 2004 US DIST LEXIS 18638



Caution

As of: May 07, 2007

PHARMASTEM THERAPEUTICS, INC., Plaintiff, v. VIACELL INC., et al., Defendants.

C.A. No. 02-148 GMS

UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE

2004 U.S. Dist. LEXIS 18638

September 15, 2004, Decided.

SUBSEQUENT HISTORY: [*1] Reconsideration granted by, in part, Injunction denied by, Judgment entered by *Pharmastem Therapeutics v. Viacell, Inc.*, 2004 U.S. Dist. LEXIS 25176 (D. Del., Dec. 14, 2004)

PRIOR HISTORY: *PharmaStem Therapeutics, Inc. v. Viacell Inc.*, 2003 U.S. Dist. LEXIS 17137 (D. Del., Sept. 30, 2003)

DISPOSITION: ViaCell, Cyro-Cell, CorCell, and CBR Systems' motion for judgment as a matter of law or for new trial granted in part. PharmaStem, Inc.'s motion for enhanced damages, attorneys' fees, pre-judgment interest and post judgment interest denied. PharmaStem, Inc.'s motion to strike and for a permanent injunction denied.

CASE SUMMARY:

PROCEDURAL POSTURE: Plaintiff patent owner filed suit against defendants for infringement of two patents directed toward: (1) cryopreserved therapeutic compositions containing hematopoietic stem cells, and (2) methods pertaining to the therapeutic use of such compositions. After a jury returned a verdict for the owner, defendants filed a renewed motion for judgment as a matter of law or, in the alternative, a motion for a new trial or a remittitur.

OVERVIEW: In the owner's infringement suit, defendants asserted the defenses of invalidity for anticipation, inequitable conduct, and obviousness. A jury found that the patents were valid and that defendants willfully infringed their claims. On defendants' motion, the court

held that defendants were entitled to judgment as a matter of law on the claim of infringement with respect to the second patent because, although there was substantial evidence to support the jury's verdict that the patent was not obvious, anticipated, or indefinite, the owner failed to adduce evidence that defendants sold or offered to sell a component of the patented process, specifically, cord blood units. Thus, the owner failed to prove that defendants contributorily infringed the second patent. The court further held that defendants were entitled to a new trial on the issue of infringement with respect to the first patent because the testimony of the owner's infringement expert—that 100 percent of defendants' cord blood units infringed the first patent—was based upon a legally improper methodology and was unreliable as a matter of law under Daubert. Thus, it should not have been admitted.

OUTCOME: The court entered judgment as a matter of law that defendants did not infringe the second patent and granted a partial new trial on the issue of infringement of the first patent.

LexisNexis(R) Headnotes

Civil Procedure > Trials > Judgment as Matter of Law > General Overview

[HN1] Pursuant to *Fed. R. Civ. P. 50*, a court may render judgment as a matter of law after the moving party is fully heard on an issue at trial if there is no legally sufficient evidentiary basis for a reasonable jury to find for that party on that issue.

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Civil Procedure > Trials > Judgment as Matter of Law > General Overview

[HN2] If a court denies a motion for judgment as a matter of law during trial, the motion may be renewed within 10 days of entry of judgment in the case. *Fed. R. Civ. P. 50(b)*.

Civil Procedure > Trials > Judgment as Matter of Law > General Overview**Civil Procedure > Appeals > Standards of Review > Substantial Evidence > General Overview**

[HN3] To prevail on a renewed motion for judgment as a matter of law following a jury trial, a party must show that the jury's findings, presumed or express, are not supported by substantial evidence or, if they are, that the legal conclusions implied by the jury's verdict cannot in law be supported by those findings.

Civil Procedure > Appeals > Standards of Review > Substantial Evidence > General Overview

[HN4] Substantial evidence is such relevant evidence from the record taken as a whole as might be accepted by a reasonable mind as adequate to support the finding under review.

Civil Procedure > Appeals > Standards of Review > Substantial Evidence > General Overview

[HN5] In assessing the sufficiency of the evidence supporting a jury's findings, a court must draw all reasonable inferences from the evidence in the light most favorable to the nonmovant.

Civil Procedure > Appeals > Standards of Review > Substantial Evidence > General Overview

[HN6] In assessing the sufficiency of the evidence supporting a jury's findings, the appropriate inquiry is whether a reasonable jury, given the facts before it, could have arrived at the conclusion it did.

Civil Procedure > Judgments > Relief From Judgment > Motions for New Trials**Civil Procedure > Appeals > Standards of Review > Substantial Evidence > General Overview**

[HN7] In assessing the sufficiency of the evidence supporting a jury's findings, a court may not determine the credibility of the witnesses nor substitute its choice for that of the jury between conflicting elements of the evidence.

Civil Procedure > Judgments > Relief From Judgment > Motions for New Trials**Civil Procedure > Judgments > Relief From Judgment > Motions to Alter & Amend**

[HN8] A court may grant a new trial pursuant to *Fed. R. Civ. P. 59* for any of the reasons for which new trials have been granted in actions of law in the courts of the United States. *Fed. R. Civ. P. 59(a)*.

Civil Procedure > Judgments > Relief From Judgment > Motions for New Trials

[HN9] A court should grant a new trial in a jury case only if the verdict is against the weight of the evidence and a miscarriage of justice will result if the verdict is to stand. In making this determination, the trial judge should consider the overall setting of the trial, the character of the evidence, and the complexity or simplicity of the legal principles which the jury had to apply to the facts.

Patent Law > Inequitable Conduct > Effect, Materiality & Scierter > General Overview**Patent Law > Nonobviousness > Elements & Tests > Prior Art****Patent Law > Nonobviousness > Evidence & Procedure > Fact & Law Issues**

[HN10] Whether or not a patent is obvious over the prior art is a question of law.

Patent Law > Nonobviousness > Elements & Tests > Claimed Invention as a Whole**Patent Law > Nonobviousness > Elements & Tests > Prior Art**

[HN11] See 35 U.S.C.S. § 103.

Patent Law > Nonobviousness > Elements & Tests > General Overview

[HN12] An invention is invalid if the difference between the new thing and what was known before is not considered sufficiently great to warrant a patent.

Patent Law > Nonobviousness > Elements & Tests > Hindsight

[HN13] Obviousness cannot be based on the hindsight combination of components selectively culled from the prior art to fit the parameters of the invention.

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Patent Law > Claims & Specifications > Enablement Requirement > General Overview***Patent Law > Nonobviousness > Elements & Tests > Ordinary Skill Standard******Patent Law > Nonobviousness > Elements & Tests > Prior Art***

[HN14] The United States Supreme Court has set forth four factors relevant to determining obviousness: (1) the scope and content of the prior art; (2) the differences between the claimed invention and the prior art; (3) the level of ordinary skill in the art; and (4) other secondary considerations.

Healthcare Law > Treatment > Blood & Organ Donations > General Overview***Patent Law > Nonobviousness > Elements & Tests > Prior Art***

[HN15] Both a suggestion to make a composition or carry out a claimed process and a reasonable expectation of success must be found in the prior art to support a conclusion that a patent is obvious.

Patent Law > Anticipation & Novelty > Description in Publications***Patent Law > Claims & Specifications > Enablement Requirement > General Overview******Patent Law > Inequitable Conduct > Effect, Materiality & Scientist > General Overview***

[HN16] An anticipating reference must describe the patented subject matter with sufficient clarity and detail to establish that the subject matter existed in the prior art and that such existence would be recognized by persons of ordinary skill in the field of the invention.

Patent Law > Claims & Specifications > Definiteness > General Overview

[HN17] See 35 U.S.C.S. § 112.

Patent Law > Claims & Specifications > Definiteness > General Overview

[HN18] 35 U.S.C.S. § 112 requires a patentee to provide the public with clear notice of what activities infringe the patent. If the claims, read in light of the specifications, reasonably apprise those skilled in the art both of the utilization and scope of the invention, and if the language is as precise as the subject matter permits, the courts can demand no more.

Patent Law > Claims & Specifications > Claim Language > General Overview***Patent Law > Claims & Specifications > Definiteness > Precision Standards******Patent Law > Claims & Specifications > Description Requirement > General Overview***

[HN19] If patent claims, read in light of the specifications, reasonably apprise those skilled in the art both of the utilization and scope of the invention, and if the language is as precise as the subject matter permits, the courts can demand no more.

Civil Procedure > Trials > Jury Trials > Province of Court & Jury***Patent Law > Claims & Specifications > Definiteness > General Overview***

[HN20] Indefiniteness is a question of law for the court.

Civil Procedure > Trials > Jury Trials > Province of Court & Jury***Patent Law > Claims & Specifications > Definiteness > General Overview***

[HN21] In a jury trial, if there are disputed factual issues related to indefiniteness, they may be submitted to the jury for resolution.

Evidence > Procedural Considerations > Burdens of Proof > Clear & Convincing Proof***Patent Law > Infringement Actions > Burdens of Proof > Patent Law > Infringement Actions > Defenses > Patent Invalidity > Validity Presumption***

[HN22] As a patent is presumed valid, a party asserting a defense of invalidity on the basis of claim indefiniteness bears the burden of proof by clear and convincing evidence.

International Trade Law > Imports & Exports > General Overview***Patent Law > Infringement Actions > Infringing Acts > General Overview******Patent Law > Subject Matter > Products > Machines***

[HN23] See 35 U.S.C.S. § 271(c).

Patent Law > Infringement Actions > Infringing Acts > Contributory, Indirect & Induced Infringement

[HN24] Liability under 35 U.S.C.S. § 271(c) is clearly dependant upon the accused infringer's selling or offering to sell a component of a patented process.

Evidence > Procedural Considerations > Burdens of Proof > Clear & Convincing Proof

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Patent Law > Claims & Specifications > Enablement Requirement > General Overview***Patent Law > Originality > Joint & Sole Inventorship***

[HN25] Every patent receives the presumption that its inventors are the true and only inventors. Invalidity for failure to name an inventor must be established by clear and convincing evidence. To be a joint inventor, one must contribute in some significant manner to the conception of the invention. Specifically, each person claiming to be an inventor must have contributed to the conception of the invention. Beyond conception, the purported inventor must demonstrate that he made a contribution to the claimed invention that is not insignificant in quality, when contribution is measured against the dimension of the full invention, and did more than merely explain to the real inventors well-known concepts and/or the current state of the art.

Patent Law > Inequitable Conduct > Burdens of Proof***Patent Law > Inequitable Conduct > Effect, Materiality & Scienter > Effect of Inequitable Conduct***

[HN26] The burden is on a party seeking to invalidate a patent to prove inequitable conduct by clear and convincing evidence.

Evidence > Procedural Considerations > Burdens of Proof > Clear & Convincing Proof***Patent Law > Inequitable Conduct > Effect, Materiality & Scienter > Elements***

[HN27] One who alleges inequitable conduct arising from a failure to disclose prior art must offer clear and convincing proof of the materiality of the prior art, knowledge chargeable to the applicant of that prior art and of its materiality, and the applicant's failure to disclose the prior art, coupled with an intent to mislead the Patent & Trademark Office. Materiality and intent to deceive are distinct factual inquiries, and each must be shown by clear and convincing evidence.

Patent Law > Inequitable Conduct > Burdens of Proof***Patent Law > Inequitable Conduct > Effect, Materiality & Scienter > Duties***

[HN28] Patent applicants have a duty to disclose to the Patent & Trademark Office any material prior art or other information cited or brought to their attention in any related foreign application.

Patent Law > Inequitable Conduct > Burdens of Proof***Patent Law > Inequitable Conduct > Effect, Materiality & Scienter > Duties***

[HN29] A finding of inequitable conduct for nondisclosure of information requires proof that the applicant made a deliberate decision to withhold a known material reference from the Patent & Trademark Office.

Evidence > Scientific Evidence > Daubert Standard***Evidence > Testimony > Experts > Daubert Standard******Evidence > Testimony > Experts > Helpfulness***

[HN30] *Fed. R. Evid. 702* has three requirements as to expert opinions: (1) the witness must be an expert; (2) the witness must testify to scientific, technical, or other specialized knowledge; and (3) the testimony must assist the trier of fact. The U.S. Supreme Court's decision in *Daubert*, established a gatekeeping role for trial court judges in determining the admissibility of expert testimony on scientific evidence. When an expert bases opinion testimony on scientific knowledge, the testimony will not be admitted unless it is derived by the scientific method and is supported by "appropriate validation." This standard of evidentiary reliability focuses on the scientific validity of the expert's methods rather than the soundness of his specific conclusions. The inquiry into the reliability of scientific evidence requires a determination as to its scientific validity. An expert's opinion is reliable if it is based on the "methods and procedures of science" rather than on "subjective belief or unsupported speculation"; the expert must have "good grounds" for his or her belief.

Evidence > Relevance > Confusion, Prejudice & Waste of Time***Evidence > Testimony > Experts > General Overview***

[HN31] An *Fed. R. Evid. 403* exclusion of expert testimony is proper where the evidence is susceptible of elucidation without specialized knowledge and jury can ascertain it through common sense.

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Jeffrey L. Moyer, Esquire of Richards Layton & Finger, Wilmington, Delaware, Richard D. Kirk, Esquire of Morris James Hitchens & Williams LLP, Wilmington, Delaware, and Robert F. Stewart, Esquire of Dilworth Paxson LLP, Wilmington, Delaware. Counsel for Defendants. Of Counsel: Paul F. Ware, Esquire, John C. Englander, Esquire, James C. Rehnquist, Esquire, [*2] James W. McGarry, Esquire, and Elaine Herrmann Blais, Esquire of Goodwin Procter LLP, Boston, Massachusetts; William F. Abrams, Esquire, Thomas F. Chaffin,

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Esquire and Randal Ivor-Smith, Esquire of Pillsbury Winthrop LLP, Palo Alto, California; and James L. Rodgers, Esquire, Evelyn H. McConathy, Esquire, and Lisa Burgin Conte, Esquire of Dilworth Paxson LLP, Philadelphia, Pennsylvania.

JUDGES: Gregory M. Sleet, UNITED STATES DISTRICT JUDGE.

OPINION BY: Gregory M. Sleet

OPINION:

MEMORANDUM OPINION

September 15, 2004

Wilmington, DE

SLEET, District Judge

I. INTRODUCTION

On February 22, 2002, PharmaStem Therapeutics, Inc. ("PharmaStem") filed suit against ViaCell, Inc. ("ViaCell"), Cryo-Cell International, Inc. ("Cryo-Cell"), CorCell, Inc. ("CorCell"), StemCyte, Inc. ("StemCyte"), CBR Systems, Inc. ("CBR"), Birthcells Technology, Inc. ("Birthcells"), Nustem Technologies, Inc. ("Nustem"), and Bio-Cell, Inc. ("Bio-Cell") (collectively "ViaCell" or "the defendants") n1, alleging infringement of *United States Patents Nos. B1 5,004,681* ("[*3] '681 Patent") and *5,192,553* ("'553 Patent") (collectively "the Patents-In-Suit"). The Patents-In-Suit are generally directed toward cryopreserved therapeutic compositions containing hematopoietic stem cells obtained from umbilical cord or placental blood of a newborn, the '681 Patent, and methods pertaining to the therapeutic use of such compositions, the '553 Patent.

n1 A default judgment was subsequently rendered against NuStem on July 10, 2002. StemCyte and PharmaStem entered a settlement agreement before trial, and StemCyte accordingly was dismissed from this action on October 21, 2003.

ViaCell asserted the defenses of invalidity for anticipation, indefiniteness, inequitable conduct and obviousness. The court held a *Markman* hearing and issued an order construing the disputed terms of the '681 and '553 Patents on January 13, 2003. A jury trial commenced on October 10, 2003. During trial, both parties properly moved for judgment as a matter of law ("JMOL") pursuant to *Rule 50(a) of the Federal Rules of*

Civil Procedure. [*4] The court reserved ruling on all JMOL motions.

On October 29, 2003, the jury returned a unanimous verdict on all claims in favor of PharmaStem. The jury found that each of the defendants infringed the claims of the '681 and '553 Patents, and that each of the defendant's infringement of those patents was willful. The jury also upheld the validity and enforceability of the Patents-In-Suit, found that PharmaStem did not commit any anti-trust violation, and awarded PharmaStem past damages in the amount of \$ 7,126,544.92. The court entered judgment on the verdict on October 30, 2003.

Following the jury's verdict, ViaCell filed a renewed motion for judgment as a matter of law, and, in the alternative, a motion for a new trial or for a remittitur. Defendants CBR, CorCell, and Cryo-Cell joined in ViaCell's motions and submitted individual memoranda addressing issues specific to each of them. ViaCell filed another alternative motion, in which the three other defendants also joined, for findings by the court and/or to alter or amend judgment pursuant to *Federal Rule of Civil Procedure 52, 59(e)* and/or the court's equitable power. PharmaStem filed a motion for enhanced damages, attorneys' [*5] fees, pre judgment interest and post judgment interest, a motion for a permanent injunction, as well as a motion to strike the affidavit of Chris Adams submitted in support of ViaCell's motion to alter or amend the judgment. Addressing these motions collectively herein, the court will enter judgment as a matter of law that defendants do not infringe the '553 patent and grant a partial new trial on the issue of infringement of the '681 Patent.

II. STANDARDS OF REVIEW

A. Renewed Motion for Judgment as a Matter of Law

[HN1] Pursuant to *Federal Rule of Civil Procedure 50*, a court may render judgment as a matter of law after the moving party is fully heard on an issue at trial, if "there is no legally sufficient evidentiary basis for a reasonable jury to find for that party on that issue." *Walter v. Holiday Inns, Inc.*, 985 F.2d 1232, 1238 (3d Cir. 1993) (citation omitted). [HN2] If the court denies a motion for JMOL during trial, the motion may be renewed within ten days of entry of judgment in the case. *FED. R. CIV. P. 50(b)*. [HN3] To prevail on a renewed motion for JMOL following a jury trial, a party "must show that the jury's findings, presumed or express, are not [*6] supported by substantial evidence or, if they were, that the legal conclusion(s) implied [by] the jury's verdict cannot in law be supported by those findings." *Pannu v. Iolab Corp.*, 155 F.3d 1344, 1348 (Fed. Cir. 1998) (quoting *Perkin-Elmer Corp. v. Computervision Corp.*, 732 F.2d

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888, 893 (*Fed. Cir. 1984*)). [HN4] "Substantial" evidence is such relevant evidence from the record taken as a whole as might be accepted by a reasonable mind as adequate to support the finding under review." *Perkin-Elmer Corp.*, 732 F.2d at 893. [HN5] In assessing the sufficiency of the evidence, the court must draw all reasonable inferences from the evidence in the light most favorable to the nonmovant. *Id.*; *Richardson-Vicks Inc. v. Upjohn Co.*, 122 F.3d 1476, 1479 (*Fed. Cir. 1997*). [HN6] The appropriate inquiry is whether a reasonable jury, given the facts before it, could have arrived at the conclusion it did. *Dawn Equip. Co. v. Kentucky Farms, Inc.*, 140 F.3d 1009, 1014 (*Fed. Cir. 1998*). [HN7] The court may not determine the credibility of the witnesses nor "substitute its choice for that of the jury between conflicting elements of [*7] the evidence." *Perkin-Elmer Corp.*, 732 F.2d at 893.

B. Motion for a New Trial

[HN8] The court may grant a new trial pursuant to *Federal Rule of Civil Procedure 59* "for any of the reasons for which new trials have heretofore been granted in actions of law in the courts of the United States." *FED. R. CIV. P. 59(a)*. [HN9] A court should grant a new trial in a jury case, however, only if "the verdict was against the weight of the evidence . . . [and] a miscarriage of justice would result if the verdict were to stand." *Williamson v. Consolidated Rail Corp.*, 926 F.2d 1344, 1352 (3d Cir. 1991). In making this determination, the trial judge should consider the overall setting of the trial, the character of the evidence, and the complexity or simplicity of the legal principles which the jury had to apply to the facts. *Lind v. Schenley Industries, Inc.*, 278 F.2d 79, 89 (3d Cir.), cert. denied, 364 U.S. 835, 5 L. Ed. 2d 60, 81 S. Ct. 58 (1960).

III. DISCUSSION

A. Defendants' Renewed Motion for Judgment as a Matter of Law

1. The Jury's Verdict That the Patents-In-Suit Are Not Obvious, Anticipated or [*8] Indefinite Is Supported by Substantial Evidence.

a. Obviousness

The defendants contend that both the '681 and '553 *Patents* are invalid as obvious under 35 U.S.C. § 103. [HN10] Whether or not a patent is obvious over the prior art is a question of law. See *Richardson-Vicks v. Upjohn Co.*, 122 F.3d 1476, 1479 (*Fed. Cir. 1997*); see also *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1384-85 (*Fed. Cir. 2001*). Section 103 provides:

[HN11] A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

35 U.S. § 103. Put simply, [HN12] an invention is invalid if "the difference between the new thing and what was known before is not considered sufficiently great to warrant a patent." [*9] *Graham v. John Deere Co.*, 383 U.S. 1, 15, 15 L. Ed. 2d 545, 86 S. Ct. 684 (1966). [HN13] Obviousness cannot be based on "the hindsight combination of components selectively culled from the prior art to fit the parameters of the invention." *ATD Corp. v. Lydall, Inc.*, 159 F.3d 534, 546 (*Fed. Cir. 1998*). [HN14] The Supreme Court has set forth four factors relevant to determining obviousness: (1) the scope and content of the prior art; (2) the differences between the claimed invention and the prior art; (3) the level of ordinary skill in the art; and (4) other secondary considerations. *Graham*, 383 U.S. at 17-18. Evaluating the *Graham* factors in view of the evidence adduced at trial, it was not unreasonable for the jury to have concluded that the Patents-In-Suit were not obvious.

Indeed, PharmaStem proffered ample evidence to support the jury's verdict. [HN15] Both a suggestion to make the composition or carry out the claimed process and a reasonable expectation of success must be found in the prior art to support a conclusion that a patent is obvious. See [*10] *In re Vaeck*, 947 F.2d 488, 493 (*Fed. Cir. 1991*). At trial, PharmaStem presented testimony that there were problems associated with transplant tissues used prior to the Patents-In-Suit. Bernstein Tr. at 2035-2038. There was also tremendous skepticism in the transplant field regarding the use of cord blood as a transplant tissue. Bernstein Tr. at 2043-204, and the references ViaCell asserts (namely Koike, Knudtzon and Vidal) did not overcome this skepticism. Bernstein Tr. at 2045-2048, 2054-2060. Finally, testimony established that those in the field of transplantation were surprised at the result of the first cord blood transplant conducted by the inventors of the Patents-In-Suit. Bernstein Tr. at 2061-2062. See also Wagner Tr. at 1378-1379. It is true that ViaCell capably highlights record evidence as to the meaning one of ordinary skill would attach to the alleged prior art references. Base upon the record evidence, a jury could have found that the Patents-In-Suit were obvious. This jury did not, however, and the aforementioned

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evidence provided it with sufficient basis to reach the conclusion that, prior to the inventions of the Patents-In-Suit, those in the [*11] field of hematopoietic reconstitution would not have expected cord blood to be a successful transplant tissue.

The jury also received an abundance of evidence to support the secondary considerations of long felt need, commercial success, failure of others, copying, and unexpected results. *See e.g.*, Bernstein Tr. at 2036, 2060-2061; Wagner Tr. at 1187; Tr. Ex. 413. Additionally, with respect to the '681 patent, the jury was permitted to consider the fact that the Patent and Trademark Office ("PTO") considered the alleged prior art in the reexamination and ultimate reissue of that patent. Similarly, during examination of the '553 Patent, the PTO considered the Ende, Prindull, and Knudtson references, a fact which the jury was also entitled to consider in evaluating their combined effect on the obviousness issue. The court is not to "substitute its choice for that of the jury between conflicting elements of the evidence." *Perkin-Elmer Corp.*, 732 F.2d at 893. In view of this standard, there is no basis to overturn the jury's finding that the Patents-In-Suit are not obvious.

b. Anticipation

Likewise, the jury's finding that the Patents-In-Suit are not invalid [*12] for anticipation is supported by substantial evidence. The defendants first contend that the '681 patent is anticipated by Koike because the latter discloses each limitation of the former's claims. [HN16] "An anticipating reference must describe the patented subject matter with sufficient clarity and detail to establish that the subject matter existed in the prior art and that such existence would be recognized by persons of ordinary skill in the field of the invention." The '681 Patent claims a cryopreserved therapeutic composition comprising "viable human neonatal or fetal hematopoietic stem cells derived from the umbilical cord blood or placental blood of a single human collected at the birth of said human, in which said cells are present in an amount sufficient to effect hematopoietic reconstitution of a human adult." To anticipate the '681 Patent Koike must demonstrate that stem cells were present in umbilical cord blood. There is ample evidence in the record establishing that Koike did not demonstrate stem cells. For example, Dr. Wagner's cross examination testimony stated that Koike did not prove that there were stem cells in umbilical cord blood. n2 Wagner Tr. at 1333. Dr. Bernstein [*13] also testified that the reference does not teach stem cells nor a therapeutic composition for use in hematopoietic reconstitution. Bernstein Tr. at 2053. In this regard, the jury's verdict that the '681 patent is not anticipated by Koike is supported by substantial evidence so as to preclude judgment as a matter of law on the issue of anticipation.

N2 Dr. Wagner's cross testimony could be further construed to support the conclusion that Koike did not cryopreserve enough cord blood, or teach cryopreservation of enough cord blood, for hematopoietic reconstitution of a human, whether adult or child, which is another limitation of the '681 Patent's claims. *See* Wagner Tr. at 1342-1343.

The court reaches the same conclusion with respect to the '553 Patent. The '553 Patent claims in pertinent part:

A method for hematopoietic or immune reconstitution of a human comprising:

- (a) isolating human neonatal or fetal blood components containing hematopoietic stem cells;
- (b) cryopreserving the [*14] blood components; and
- (c) introducing the blood components into a suitable human host.

It is undisputed that Koike did not introduce cord blood into a human, which is a necessary limitation of the '553 Patent. The defendants claim that Koike's suggestion that introducing the stem cells into a human host should be done is a sufficiently enabling disclosure to warrant a finding of anticipation. Even so, the record contains substantial evidence from which a jury could find that a person of ordinary skill in the art would not have been so enabled. For example, Dr. Wagner testified that Koike did not do a transplant, Wagner Tr. at 1333, and Dr. Bernstein testified that Koike does not introduce stem cells into a human or teach hematopoietic reconstitution, Bernstein Tr. at 2053-2054. Again, the jury's finding that the Patents-In-Suit are not anticipated n3 is supported by substantial evidence and the court will not overturn it on this basis.

n3 Given the absence of record evidence showing that Koike's compositions contained an amount of stem cells sufficient to effect hematopoietic reconstitution of a human adult, the de-

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fendants' inherent anticipation theory is an equally unpersuasive basis on which to enter judgment as a matter of law on this issue. Although recognition of an element in the prior art before the critical date is not necessary, inherent anticipation still requires that the element necessarily be present. *Schering Corp. v. Geneva Pharms.*, 339 F.3d 1373, 1377 (Fed. Cir. 2003).

[*15]

c. Indefiniteness

The defendants also argue that the '681 Patent is invalid because it is indefinite. Claim 1 of that patent covers "stem cells" "in an amount sufficient to effect hematopoietic reconstitution of a human adult." According to the defendants, this language is indefinite as a matter of law because it is specifically drawn to an amount of stem cells, but the patent is completely silent as to a quantity. In this regard, they claim that it does not provide sufficient notice of the scope of the invention. The court is not persuaded.

Section 112 provides in pertinent part:

[HN17] The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

35 U.S.C. § 112. [HN18] The statute requires the patentee to provide the public with clear notice of what activities infringe the patent. See [*16] *Exxon Research & Eng'g Co. v. United States*, 265 F.3d 1371, 1375 (Fed. Cir. 2001); *Morton Int'l v. Cardinal Chem. Co.*, 5 F.3d 1464, 1470 (Fed. Cir. 1993). [HN19] "If the claims, read in light of the specifications, reasonably apprise those skilled in the art both of the utilization and scope of the invention, and if the language is as precise as the subject matter permits, the courts can demand no more." *Shatterproof Glass Corp. v. Libbey-Owens Ford Co.*, 758 F.2d 613, 624 (Fed. Cir. 1985) (citing *Georgia Pacific Corp. v. United States Plywood Corp.*, 258 F.2d 124, 136 (2d Cir. 1958)). [HN20] Indefiniteness is a question of law for the court. *In re Jolly*, 36 C.C.P.A. 825, 172 F.2d 566, 570, 1949 Dec. Comm'r Pat. 111 (C.C.P.A. 1949); see also *Union Pacific Res. Co. v. Chesapeake Energy Corp.*, 236 F.3d 684, 692 (Fed. Cir. 2001). [HN21] "In a

jury trial, if there are disputed factual issues related to indefiniteness, they may be submitted to the jury for resolution." [*17] *Union Carbide Chems. & Plastics Tech. Corp. v. Shell Oil Co.*, 2004 U.S. Dist. LEXIS 10730, Nos. 99-274 (SLR), 99-876 (SLR), 2004 WL 1305849, *10(D. Del. 2004) (citing *BJ Services Co. v. Halliburton Energy Servs., Inc.*, 338 F.3d 1368, 1372 (Fed. Cir. 2003)). [HN22] Because a patent is presumed valid, the party asserting a defense of invalidity on the basis of claim indefiniteness bears the burden of proof by clear and convincing evidence. See *Orthokinetix, Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1575-76 (Fed. Cir. 1986).

It is true that the language of the '681 Patent does not specify an amount of progenitor cells nor a volume of cord blood, and the specification is silent as to a precise amount. However, these facts do not necessarily dictate that Claim 1 must fail for indefiniteness. Given that there is no determinate or determinable minimum amount of cord blood for therapeutic usefulness in humans, the record supports that the '681 Patent's claim language is as precise as the subject matter permits. Moreover, the record contains evidence establishing that a person of skill in the art would have understood [*18] what an amount of cord blood stem cells sufficient to effect hematopoietic reconstitution of a human adult means. See *Andrew Corp. v. Gabriel Electronics, Inc.*, 847 F.2d 819, 823 (Fed. Cir. 1988); *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1385 (Fed. Cir. 1986). Dr. Moore, PharmaStem's expert on hematopoiesis, testified that the Patents-In-Suit provide the reader with ample information to determine the amount of cord blood needed for transplantation in adults or children, and that the scientific community has in fact performed numerous transplants into adults. Moore Tr. at 340-348; see also Harris Tr. at 635-636 (for defendants' witness skilled in art stating that an amount sufficient for usefulness in a clinical setting would be "a sample that contained enough of those cells for a successful transplant"). Thus, the court can find no basis to overturn the jury's verdict that the '681 Patent is not invalid for indefiniteness.

2. The Jury's Verdict That the Defendants Contributorily Infringe the [*19] '553 Patent Cannot Stand.

The defendants claim that PharmaStem did not prove that they contributorily infringed the '553 Patent in that PharmaStem failed to adduce evidence that any of them sold or offered to sell cryopreserved cord blood to a transplanter or that cryopreserved cord blood was used by a single entity or group of entities acting in concert or working together to infringe the patent. The court agrees. Relevantly, the claim language of the '553 Patent requires:

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A method for obtaining human neonatal or fetal hematopoietic stem or progenitor cells comprising:

- (a) isolating human neonatal or fetal blood components containing hematopoietic stem or progenitor cells;
- (b) cryopreserving the blood components; and
- (c) thawing the blood components, such that the stem or progenitor cells are viable.

Because none of the defendants thaw or inject cord blood, both required elements of the '553 Patent's claims, there can be no literal infringement of the '553 Patent.

PharmaStem would, however, still be entitled to a finding of infringement if the jury reasonably could have found that the defendants contributorily infringed the [*20] '553 patent. See 35 U.S.C. § 271(c).

Section 271(c) states:

[HN23] Whoever offers to sell or sells within the United States or imports into the United States a component of a patented machine, manufacture, combination or composition, or a material or apparatus for use in practicing a patented process, constituting a material part of the invention, knowing the same to be especially made or especially adapted for use in an infringement of such patent, and not a staple article or commodity of commerce suitable for substantial noninfringing use, shall be liable as a contributory infringer.

35 U.S.C. § 271. The verdict form required the jury to answer three questions in the affirmative in order to find that any of the defendants contributorily infringed the '553 patent. Consistent with the appropriate legal standard, the jury was required to find that (I) "cryopreserved cord blood has no substantial noninfringing use," (ii) "defendants and transplant physicians are acting in con-

cert or working together to complete the process of infringement of claims 13, 19, 47, or 57 of the [*21] '553 patent by performing each and every one of the steps in any of those claims," and (iii) "a Defendant has contributorily infringed the '553 patent by selling or offering to sell cryopreserved cord blood that was actually used by a third party in the direct infringement of any of claims 13, 19, 47, 53, or 57 of the '553 patent." Jury Verdict Form, Qtn. Nos. 3, 4, and 5.

PharmaStem correctly points out the existence of evidence to support the jury's affirmative answer to questions (I) and (ii) of the verdict form. The record supports a conclusion that cryopreserved cord blood is, predominantly, useful only for transplantation therapy, or the use covered by the '553 Patent. Indeed, PharmaStem adduced evidence by which a jury reasonably could have found that cord blood was viewed as medical waste prior to the inventions of the Patents-In-Suit. See, e.g., Moore Tr. at 328; Broxmeyer Tr. at 365; Wagner Tr. 1195-1196.

Moreover, the jury also could have reasonably found that each of the defendants worked together with transplant physicians to complete the patented process of the asserted claims of the [*22] '553 Patent. At trial, PharmaStem adduced evidence that the defendants test the blood samples to ensure each one is sufficient for transplantation and thereby aid transplant physicians. Tr. Ex. 103; Tr. Ex. 96; Laleman Tr. at 659. The defendants marketing materials also indicate that they work with physicians in various capacities to effectuate the transplantation process. For example, CorCell's website states "CorCell and Community Blood Services (CBS) has formed a strategic partnership devoted to expertly testing, processing and storing quality cord blood stem cells for future transplantation." Tr. Ex. 516. ViaCell's founder, Cynthia Fisher, testified that the company's mission was "to provide a niche application area between the obstetrician, the Hem/Onc and the blood banking center, as far as enabling providing cord blood stem cell banking." Fisher Tr. at 707. Cryo-Cell advertises that the units of cord blood stem cells stored at its facility are transplant-ready. Tr. Ex. 98. In addition, PharmaStem presented evidence that each of the defendants has at least one representative who liaises in some capacity with transplant physicians, i.e., Dr. Goldberg of CorCell and Dr. O'Neil of [*23] Cryo-Cell. CBR designates a Director of the Facility to oversee procedures regarding the release of cord blood units for transplantation. Tr. Ex. 110. Viacell seeks advice and counsel on nucleated cell counts and volumes useful for transplantation from its Medical Scientific Advisory Board, on which five of the seven members are prominent transplant doctors or physicians with extensive experience in hematology, oncology, and/or transfusion medicine. Tr. Ex. 253, Tr. at

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1461-63; *see also* Wagner Tr. at 1389. Finally, there is also evidence in the record showing that each of the defendants maintain records and/or other materials regarding its cord blood units which it releases to physicians to assist the transplantation process. CorCell maintains records on the cord blood units it releases, Tr. Ex. 274, and requests feedback from the transplant facility as part of its standard operating procedures, Tr. Ex. 215. Cryo-Cell provides directions to transplant physicians on how to thaw the cryopreserved cord blood unit it provides. Tr. Ex. 97. CBR has a similar document setting forth the detailed protocol between CBR and the transplant physician when a cord blood unit is requested and [*24] released. Tr. Ex. 110. In view of this evidence, it was not unreasonable for the jury to have found that the defendants and transplant physicians worked together to infringe the '553 patent.

Nevertheless, with respect to the third question on the verdict form, there is simply no evidence in the record to support the jury's affirmative answer. It is undisputed that the defendants do not own the cord blood units. Rather the units are owned by the clients, or families, and the defendants in turn provide services with respect to the processing and storing of the compositions. Although the defendants charge enrollment, processing, and banking fees with respect to their storage services, they do not *sell* or *offer to sell* the cord blood units. Indeed, the record evidence on this issue is clear that the defendants sell a service, not cord blood units. *See* Hendrix Tr. 1042; Tr. 2653; Wagner Tr. 1278.

Tellingly, PharmaStem cannot direct the court to a single fact in evidence that would support a finding that any of the defendants sell or offer to sell cord blood. PharmaStem attempts to overcome this deficiency in the record by arguing that Section 271(c) focuses on the financial [*25] benefit derived by the seller regardless of the source. But the statute could not be clearer. Section 271(c) [HN24] liability is clearly dependant upon the accused infringer's selling or offering to sell a component of the patented process, here cord blood units. *See* 35 U.S.C. § 271(c). Drawing all reasonable inferences from the evidence in favor of PharmaStem, the court agrees with the defendants that the jury's finding on the element of contributory infringement is not supported by substantial evidence. In this regard, the jury's verdict on contributory infringement cannot stand. The court finds as matter of law that the defendants' services do not infringe the '553 patent. n4

n4 Because the court finds that the defendants do not infringe the '553 Patent, it will not address the issue of willful infringement with respect to that patent.

B. Defendants' Motion for a New Trial

The defendants alternatively contend that the court should set aside the judgment and grant a new trial because [*26] the jury's verdict was against the great weight of the evidence. The court agrees with respect to the jury's finding that the 100 % of the defendants' cord blood units infringe the '681 patent and accordingly will grant a partial new trial on this issue.

1. Inventorship

The defendants first claim that a new trial is warranted because the great weight of the evidence established that the Patents-In-Suit are invalid for failure to name one of the inventors, Dr. Pablo Rubinstein. The court does not agree.

[HN25] Every patent receives the presumption that its inventors are the true and only inventors. *See e.g., Acromed Corp. v. Sofamor Danek Grp., Inc.*, 253 F.3d 1371, 1379 (Fed. Cir. 2001). Invalidity for failure to name an inventor must be established by clear and convincing evidence. *See id.* at 1379. To be a joint inventor, one must "contribute in some significant manner to the conception of the invention." *Fina Oil & Chem. Co. v. Ewen*, 123 F.3d 1466, 1473 (Fed. Cir. 1997). Specifically, each person claiming to be an inventor must have contributed to the conception of the invention. [*27] *Acromed*, 253 F.3d at 1379. Beyond conception, the purported inventor must demonstrate that he made "a contribution to the claimed invention that is not insignificant in quality, when contribution is measured against the dimension of the full invention, and [did] more than merely explain to the real inventors well-known concepts and/or the current state of the art." *Id.* at 1379.

Although the defendants point to evidence from which a jury could have found Dr. Rubinstein's contributions to be significant, PharmaStem adduced at least an equal amount of evidence that his contribution did not rise to the level of inventorship. Indeed, a jury could conclude from the record that Dr. Rubinstein provided consultation on cryopreservation methods which were already available in the art. *See* Bernstein Tr. at 1176-1177. Moreover, Dr. Rubinstein admitted that he published his cryopreservation techniques more than one year prior to the inventions of the Patents-In-Suit, Rubinstein Tr. at 1176-1177, which would allow a jury to conclude that any contribution he made was rendered prior art by the time of the patenting of the invention. *See* 35 U.S.C. § 102 [*28] ; *Hess v. Advanced Cardiovascular Sys.*, 106 F.3d 976, 981 (Fed. Cir. 1997). In light of these significant pieces of evidence supporting the jury's finding that Dr. Rubinstein was not improperly omitted as an inventor, the court finds no basis to grant a new trial on the issue of invalidity for failure to name an inventor.

2. Inequitable Conduct

The defendants also argue that the jury's finding that PharmaStem did not engage in inequitable conduct before the PTO in the procurement of the '681 and '553 Patents is against the great weight of the evidence. The court, however, is not persuaded that the jury's finding on this issue warrants a new trial. [HN26] The burden is on the party seeking to invalidate the patents to prove inequitable conduct by clear and convincing evidence. In view of the defendants' burden, the jury's verdict was not against the great weight of the evidence.

As evidence of PharmaStem's alleged inequitable conduct, the defendants point to the PharmaStem's failure to disclose two pieces of information to the PTO. First, after PharmaStem had presented its arguments to the PTO in reexamination, but several months before the '681 Patent reissued, [*29] the European Patent Office ("EPO") denied PharmaStem's European counterpart application, rejecting its argument that Koike does not teach stem cells. PharmaStem did not bring the EPO's rejection of its argument to the attention of the PTO before reissue. Second, in its opinion, the EPO cites the 1997 Broxmeyer article for the proposition that relevant scientific community considered progenitor cell assays to be reliable assays for stem cells. In view of these facts, the defendants argue that the jury's finding that PharmaStem did not engage in inequitable conduct before the PTO is against the great weight of the evidence.

[HN27] "One who alleges inequitable conduct arising from a failure to disclose prior art must offer clear and convincing proof of the materiality of the prior art, knowledge chargeable to the applicant of that prior art and of its materiality, and the applicant's failure to disclose the prior art, coupled with an intent to mislead the PTO." *Molins*, 48 F.3d at 1178; accord *Rockwell Techs. LLC v. Spectra-Physics Lasers, Inc.*, 2002 U.S. Dist. LEXIS 5180, 2002 WL 531555, at *3 (D. Del. Mar. 26, 2002) [*30]. "Materiality and intent to deceive are distinct factual inquiries, and each must be shown by clear and convincing evidence." *Life Techs., Inc. v. Clontech Lab., Inc.*, 224 F.3d 1320, 1324 (Fed. Cir. 2000); accord *ISCO Int'l, Inc. v. Conductus, Inc.*, 279 F. Supp. 2d 489, 2003 WL 22006253, at *6 (D. Del. 2003); [HN28] Patent applicants have a duty to disclose to the PTO "any material prior art or other information cited or brought to their attention in any related foreign application." Manual of Patent Examining Procedure § 2001.06(a) (4th ed., rev. 8, Oct. 1981). However, [HN29] a finding of inequitable conduct for nondisclosure of information requires proof that the applicant made a deliberate decision to withhold a known material reference from the PTO. See *Molins PLC v. Textron, Inc.*, 48 F.3d 1172, 1181 (Fed. Cir. 1995).

Given the controlling standards, PharmaStem adduced significant evidence to rebut the defendants' inequitable conduct case. Specifically, the EPO's decision applied European, as opposed to United States, patent laws, and examined different claims than the ones at issue before the PTO in the reexamination. Tr. Ex. 1013. [*31] Moreover, there is no dispute that PharmaStem disclosed Koike to the PTO in the reexamination, and that the PTO came to its own conclusion as to what the reference taught. With respect to the Broxmeyer article, it was published nearly ten years after the initial filing of the Patents-In-Suit, and therefore not a prior art reference. Tr. Ex. 1015. Further lending credence to PharmaStem's view that the article was not material, the EPO characterized the Broxmeyer article as "indirect evidence" and cited it in the portion of the opinion on novelty, which was not at issue in the reexamination before the PTO. Tr. Ex. 1013. When viewed as a whole, the record more than supports a conclusion that PharmaStem did not possess the requisite intent to deceive the PTO and therefore did not engage in inequitable conduct.

3. Infringement of the '681 Patent

a. Dr. Hendrix's Testimony

As one of the bases for their motion for a new trial on infringement of the '681 Patent, the defendants contend that Dr. Mary Hendrix, PharmaStem's infringement expert, should not have been permitted to testify. During the pretrial stage of proceedings, the defendants objected to Dr. Hendrix's [*32] testimony in a motion *in limine* and then again at the close of trial moved to strike the doctor's testimony. The court denied both of these motions, but will revisit its rulings in light of the evidentiary record now before it.

[HN30] Rule 702 has three requirements as to expert opinions: 1) the witness must be an expert; (2) the witness must testify to scientific, technical, or other specialized knowledge; and 3) the testimony must assist the trier of fact. See *United States v. Velasquez*, 64 F.3d 844, 849, 33 V.I. 265 (3d Cir. 1995) (citations omitted). The U.S. Supreme Court's decision in *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579, 125 L. Ed. 2d 469, 113 S. Ct. 2786 (1993), established a gatekeeping role for trial court judges in determining the admissibility of expert testimony on scientific evidence. When an expert bases opinion testimony on scientific knowledge, the testimony will not be admitted unless it is derived by the scientific method and is supported by "appropriate validation." [*33] *Daubert*, at 590. This standard of evidentiary reliability focuses on the scientific validity of the expert's methods rather than the soundness of his specific conclusions. *Id.* at 589 ("[the] inquiry into the reliability of, scientific evidence . . . requires a determination as to its scientific validity."); see also *Oddi v. Ford Motor Co.*,

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234 F.3d 136, 145 (3d Cir. 2000); *United States v. Shea*, 957 F. Supp. 331 at 337. An expert's opinion is reliable if it is based on the "methods and procedures of science" rather than on "subjective belief or unsupported speculation"; the expert must have "good grounds" for his or her belief. See *Daubert*, 509 U.S. at 589.

The defendants contend that the subject of Dr. Hendrix's testimony was not one for which expertise was necessary in that she based her infringement opinion entirely on an analysis of the defendants' marketing materials, without ever considering any data regarding the composition of the defendants' cord blood units. Dr. Hendrix is an accomplished stem cell biologist, but is not qualified as an expert in marketing or advertising. [*34] Moreover, her so-called analysis of the defendants' marketing materials was well within the jury's common knowledge, common sense and common experience. See *United States v. Stevens*, 935 F.2d 1380, 1399-1400 (3d Cir. 1991) (upholding [HN31] *Federal Rule of Evidence* 403 exclusion of expert testimony regarding eye witness identification where the evidence was susceptible of elucidation without specialized knowledge and jury could have ascertained through common sense). In view of these considerations, the court is persuaded that Dr. Hendrix's conclusion, evidenced in her expert report and adduced through her testimony, that 100 % of the defendants' cord blood units infringe the '681 Patent was based upon a legally improper methodology that was unreliable as a matter of law under *Daubert*.

Significantly, Dr. Hendrix's admitted that she did not review or analyze any of the defendants' cord blood samples in reaching her opinion. Hendrix Tr. at 1038. Moreover, she explicitly testified that her opinion that all of the defendants' cord blood units infringe the [*35] '681 Patent was based on the fact that the defendants "promise stem cells for pediatric and adult transplantation." Hendrix Tr. at 1021. In this regard, her opinions are not based upon any methods or procedures of science in general and certainly not upon her specific expertise as a stem cell biologist, no matter how knowledgeable she may have been in that field. The court therefore determines that her opinion of infringement is no more than a lay-person's interpretation of the defendants' marketing materials. The materials relied upon by Dr. Hendrix may be persuasive on the issue of infringement, but permitting PharmaStem to couch its presentation of this evidence in the form of an expert opinion was an error.

B. The Lack of Record Evidence that 100 % of the Defendants' Units Infringe the '681 Patent

Claim 1 of the '681 Patent covers compositions containing stem cells "in an amount sufficient to effect hematopoietic reconstitution of a human adult." To prove infringement, therefore, PharmaStem was required to

adduce evidence that the defendants cord blood units contained an amount of stem cells sufficient for transplantation into an adult. In the absence of Dr. [*36] Hendrix's testimony, the record is void of any proof to support a finding that 100 % of the defendants' cord blood units infringe the '681 Patent. To the contrary, the record overwhelmingly indicates that cord blood units will *not all* contain sufficient cells to reconstitute an adult. See Wagner Tr. at 1270; see also Tr. Ex. 1370 at 30 (PharmaStem telling the PTO that cord blood units "are highly variable in their stem cell content such that any particular cord blood collection may have low or no stem cells"). The jury's finding that *all* of the defendants' cord blood units infringe the '681 Patent, consequently, was against the great weight of the evidence.

At the same time, however, the record suggests that at least some of the defendants' cord blood units infringe in that there is evidence of successful transplants of the defendants' compositions into human adults. See, e.g., Tr. Ex. 115 (circumstantial evidence in the form of statements on CBR's website that a "newborn's cord blood stem cells were transplanted to her mother to treat chronic myelogenous leukemia," and that other transplants have occurred for the newborn's mother father and cousin); Tr. Ex. 103 [*37] (draft of ViaCord's private placement memorandum acknowledging that adult transplants have occurred). As a result, the court will grant a new trial, excluding Dr. Hendrix's expert testimony, on the issue of infringement of the '681 Patent and the resultant damages therefrom. n5

n5 Again, in light of its granting a new trial on the infringement issue, the court will not rule on the issue of willful infringement with respect to the '681 Patent.

IV. CONCLUSION

For the aforementioned reasons, the court will enter judgment as a matter of law that the defendants do not infringe the '553 Patent and grant a new trial on the issue of infringement and damages with respect to the '681 Patent. In all other aspects, the motions filed by the parties are denied. An order to this effect will accompany this opinion.

ORDER

For the reasons set forth in the court's memorandum opinion issued contemporaneously herewith, IT IS HEREBY ORDERED that:

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1. Joint Renewed Motion by ViaCell, Inc, Cyro-Cell, Inc, [*38] CorCell, Inc, CBR Systems, Inc. for Judgment as a Matter of Law or in the Alternative, for a New Trial (or for Remittitur) (D.I. 448) is GRANTED IN PART.

2. PharmaStem, Inc.'s Motion for Enhanced Damages, Attorneys' Fees, Pre-Judgment Interest and Post Judgment Interest (D.I. 446) is DENIED.

3. PharmaStem, Inc.'s Motion for a Permanent Injunction (D.I. 447) is DENIED.

4. PharmaStem's Motion to Strike the Affidavit of Chris Adams (D.I. 487) is DENIED as moot.

5. The clerk shall enter judgment in favor of the defendants and against the plaintiff on the claim of infringement of *U.S. Patent No. 5,192,553*.

6. A new trial shall be held on the issue of infringement and damages with respect to *U.S. Patent No. 5,004,681*.

Dated: September 15, 2004

Gregory M. Sleet

UNITED STATES DISTRICT JUDGE

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EXHIBIT 10

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Out-A-Sight Pet Containment, Inc. v. Radio Systems Corp.
 E.D.Pa., 2004.

Only the Westlaw citation is currently available.

United States District Court, E.D. Pennsylvania.

OUT-A-SIGHT PET CONTAINMENT, INC.,
 Plaintiff

v.

RADIO SYSTEMS CORPORATION, Radio Fence Distributors, Inc., and Lori Volwiler, Defendants
 No. Civ.A. 01-5775.

July 9, 2004.

Alexander Ewing Jr., Gollatz Griffin & Ewing PC, West Chester, PA, William Dunnegan, Perkins & Dunnegan, New York, NY, for Plaintiff.

Joseph A. Woodruff, Terrence O. Reed, Waller, Lansden, Dortch and Davis, Nashville, TN, Thomas J. Bradley, McBreen & Kopko, Philadelphia, PA, Darol H.M. Carr, David A. Holmes, Farr Farr Emerich Sifrit Hackett & Carr PA, Punta Gorda, FL, for Defendants.

MEMORANDUM

POLLAK, J.

*1 Presently before the court in this action are a second set of motions in limine by defendants Radio Systems Corporation ("RSC"), Radio Fence Distributors, Inc. ("RFD"), and RFD president Lori Volwiler (collectively, "defendants"), to exclude the testimony of Stephen J. Scherf, the damages expert for plaintiff Out-A-Sight Pet Containment, Inc. ("OAS"). For the reasons discussed herein, defendants' motions in limine will be granted.

Background

OAS, a now-defunct distributor of electronic pet containment equipment, filed suit against the defendants for breach of contract, interference with existing and prospective contractual relations, and antitrust violations. OAS alleges that, induced by RFD, RSC violated a 1999 supply agreement ("Supply Agreement") with OAS when it refused to sell a programmable receiver known as model UL-275D to OAS, which intended to resell that model under its own label. Mr. Scherf intends to testify as to

the damages incurred by OAS as a result of the defendants' alleged unlawful conduct.

Pursuant to Rule 26(a)(2)(B) of the Federal Rules of Civil Procedure, on July 24, 2002, Mr. Scherf prepared an expert report ("Report on Damages") providing valuations of OAS under three potential scenarios that might have occurred but for the defendants' alleged unlawful acts. Typically, a company's lost profits are calculated based largely on the company's historical revenues. Because OAS was essentially a start-up company with little historical revenue information, however, Mr. Scherf based his analysis primarily on OAS's business plans for fiscal years 2002-2006. The business plans were themselves based on sales projections for OAS made by Rich Weinssen, a former distributor for a competing pet containment company, Innotek.

In their initial motions in limine, filed June 20, 2003, the defendants challenged, *inter alia*, Mr. Scherf's reliance on Mr. Weinssen's sales projections. After holding a hearing, I issued a memorandum and order on December 3, 2003, granting in part the defendants' motions in limine. I found the sales projection for fiscal year 2002 to be sufficiently reliable to support expert testimony. In contrast, I found the sales projections for fiscal years 2003 to 2006—each of which assumed that OAS would experience an annual sales growth rate of 47 percent—to be speculative and thus incapable of supporting Mr. Scherf's damages estimates. In a subsequent conference call with the parties, I explained that Mr. Scherf could undertake to provide a reliable factual foundation to support Mr. Weinssen's sales projections for fiscal years 2003 to 2006—and, in turn, to support Mr. Scherf's own damages estimates—through the submission of a revised report.

On December 31, 2003, Mr. Scherf completed a supplemental expert report ("Supplemental Report"). In the Supplemental Report, Mr. Scherf offers the same damages estimates as he provided in the Report on Damages, and reiterates his opinion that the 47 percent annual sales increase projected by Mr. Weinssen was reasonable. The Supplemental Report contains three new sets of facts that purportedly support Mr. Scherf's adoption of the 47 percent figure: (1) the annual sales growth rate of RFD from 1998 or 1999 to 2002; (2) the sales growth rates of Perimeter Technologies ("Perimeter"), a distributor

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of electronic pet containment equipment run by former OAS president John Purtell, from 2000 to 2001 and 2001 to 2002; and (3) the sales growth rates of RSC from 1993 to 1997 and from 1993 to 2002.^{FN1}

Discussion

When considering a challenge to expert testimony under Rules 702 and 703, the court must assess whether there are good grounds to rely on the data adduced in support of the expert's opinion. *In re Paoli R.R. Yard PCB Litigation*, 35 F.3d 717, 748-49 (3d Cir.1994). For an expert's testimony to be admitted, his assumptions must be "accompanied by a sufficient factual foundation." *Gumbs v. Int'l Harvester, Inc.*, 718 F.2d 88, 98 (3d Cir.1983). The burden falls on the proponent of the expert testimony—here, OAS—to demonstrate by a preponderance of the evidence that the testimony is reliable. See *In re Paoli*, 35 F.3d at 744.

1. Reliability of underlying data

The defendants' central contention in their second motion in limine is that the Weinssen sales projections relied upon by Mr. Scherf continue to be unsupported by sufficient evidence and thus incapable of supporting expert testimony. This court must examine whether the new data supplied by Mr. Scherf—namely, comparative sales growth figures for RFD, Perimeter, and RSC—provide sufficient support for the Weinssen sales projections as to make Mr. Scherf's reliance on those projections reasonable. The critical question is whether these three companies in the electronic pet containment industry are comparable to OAS.

The first figure cited by Mr. Scherf arises from the deposition testimony of RFD vice president Larry Volwiler, who stated that RFD had experienced growth of "50 to 100 percent per year" over a period of "[p]robably three, maybe four" years prior to the deposition in May 2002. At the hearing, Mr. Scherf testified that in preparing the Supplemental Report he had access to no RFD sales information beyond this statement by Mr. Volwiler, and conducted no independent analysis of whether, or why, RFD experienced the growth indicated by Mr. Volwiler. It is certainly conceivable that OAS and RFD might be comparable entities. Significantly, the two companies sold, or planned to sell, the same products designed by the same manufacturer, RSC. However, several factors suggest that the two companies may not be comparable—factors that were either not considered by Mr. Scherf or not addressed in his Supplemental Report. RFD's sales were national in scope, whereas OAS intended to operate only in the northeastern United States. Furthermore, it appears that RFD has sold electronic pet containment products both

^{FN1} The Supplemental Report also comprises two other new features. The first is a list of findings from "additional market research" that, according to Mr. Scherf, indicate "strong growth" in the pet containment industry. It is questionable whether these broadly stated findings in any way bolster the reliability of the 47 percent sales growth rate adopted by Mr. Scherf. In any event, in its memorandum in opposition to the motions in limine, OAS does not even mention these findings in its discussion of the "additional evidence" in the Supplemental Report supporting Mr. Scherf's estimates. See Memorandum of Plaintiff in Opposition at 4.

Second, the Supplemental Report includes a collection of more conservative damages estimates based on a range of projected sales growth rates from 0 percent to 40 percent, calculated in 5 percent intervals. Because Mr. Scherf continues to stand by his original damages estimates, which are based on a 47 percent annual growth rate, the alternative estimates in the Supplemental Report do not assist Mr. Scherf's attempt to demonstrate a sufficient factual foundation for his expert opinion, and are thus of little use to the fact-finder in this case.

*2 The defendants responded on March 26, 2004, and April 1, 2004, with new motions in limine, raising four overarching challenges to the reliability and relevance of Mr. Scherf's proposed testimony: (1) that Mr. Scherf's damages estimates are still not supported by reliable underlying data; (2) that Mr. Scherf's opinion is irrelevant because it relates solely to damages that were not within the contemplation of the parties at the formation of the Supply Agreement; (3) that Mr. Scherf's opinion as to damages incurred beyond the termination of the Supply Agreement is irrelevant because such damages are not recoverable; and (4) that Mr. Scherf's opinion is irrelevant because OAS cannot recover speculative lost profits. I held a hearing on the new motions in limine on April 14, 2004, at which two witnesses testified on behalf of OAS: Mr. Scherf and Mr. Purtell.

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through its dealer network and, via the internet, directly to consumers. The burden is Mr. Scherf's to demonstrate that RFD and OAS are comparable companies, such that RFD's past sales growth rate of "50 to 100 percent per year" supports Mr. Scherf's adoption of an estimated 47 percent annual growth rate for OAS. I find that Mr. Scherf has failed to meet this burden.

*3 Nor does the growth rate experienced by Perimeter provide support for the 47 percent figure. In his Supplemental Report, Mr. Scherf observes that Perimeter experienced approximate growth rates of 50 percent from 2000 to 2001 and 135 percent from 2001 to 2002. Perimeter's sales, however, were boosted significantly by the withdrawal of industry leader Innotek from the electronic pet containment industry in 2001, which allowed Perimeter to sign Innotek's former dealers. Mr. Scherf concedes that such an event-the cessation of business by a major competitor-was unlikely to occur on an annual basis. Accordingly, the circumstances surrounding Perimeter's growth from 2000 to 2002 do not serve as a useful comparison to the growth that OAS would likely have experienced from 2003 to 2006.

Finally, Mr. Scherf looks for support to the growth rate of RSC, whose sales grew by approximately 39 percent from 1993 to 1997 and by approximately 32 percent from 1993 to 2002. As the defendants point out, during those periods RSC operated in a different market than the one planned for OAS. Unlike OAS, which intended to operate a dealer network that would sell dealer-installed electronic fences directly to consumers, RSC primarily sold uninstalled "off-the-shelf" electronic fences to retail stores from 1993 to 2002. At the hearing, both Mr. Scherf and OAS's counsel admitted that this difference made RSC a less relevant comparison than RFD or Perimeter. I agree, and find that the comparative sales data for RSC provides no support for the calculation of OAS's estimated annual growth rate used by Mr. Scherf.

For these reasons, I continue to find an absence of "good grounds on which to find the data reliable." *In re Paoli*, 35 F.3d at 748. The three isolated pieces of sales growth data collected by Mr. Scherf in his Supplemental Report do not provide the necessary factual foundation for his adoption of Mr. Weinssen's sales projections for fiscal years 2003 to 2006.

Mr. Scherf's expert opinion, as outlined in his Supplemental Report, takes the form of damages estimates under each of three potential business paths that OAS might have taken but for the defendants'

alleged unlawful conduct. His opinion as to damages incurred under all three scenarios is based, at least in part, on Mr. Weinssen's sales projections for fiscal years 2003 to 2006. The damages estimates under the first two scenarios rely in part on Mr. Weinssen's fiscal year 2003 projections, and the estimate under the third scenario relies in part on Mr. Weinssen's sales projections for fiscal years 2003 to 2006. Mr. Scherf's damages estimates under all three scenarios are thus based, at least in part, on data that lack sufficient factual foundation. Because these damages estimates represent the core of Mr. Scherf's proposed expert testimony as embodied in his Supplemental Report, I conclude that the proposed testimony is inadmissible.^{FN2}

FN2. Because I am excluding Mr. Scherf's proposed expert testimony on the first ground raised by the defendants-that his damages estimates are not supported by reliable underlying data-I do not address the remaining challenges to Mr. Scherf's testimony raised in the motions in limine.

Conclusion

Accordingly, in the accompanying order, I will grant the defendants' motions in limine to exclude Mr. Scherf's proposed expert testimony.

ORDER

*4 For the reasons stated in the accompanying memorandum, it is hereby ORDERED that:

(1) Radio Systems Corporation's Motion for Leave to File Reply Memorandum (Docket # 94) is GRANTED.

(2) The motions of Radio Systems Corporation (Docket # 90) and of Radio Fence Distributors, Inc. and Lori Volwiler (Docket # 91) to exclude the testimony of Stephen J. Scherf are GRANTED, and it is ORDERED that Mr. Scherf will not testify as proposed in his Supplemental Report.

E.D.Pa., 2004.

Out-A-Sight Pet Containment, Inc. v. Radio Systems Corp.

Not Reported in F.Supp.2d, 2004 WL 1562556 (E.D.Pa.)

END OF DOCUMENT

EXHIBIT 11

**THIS EXHIBIT HAS BEEN
REDACTED IN ITS ENTIRETY**

EXHIBIT 12

**THIS EXHIBIT HAS BEEN
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EXHIBIT 13

**THIS EXHIBIT HAS BEEN
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EXHIBIT 14

**THIS EXHIBIT HAS BEEN
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EXHIBIT 15

**THIS EXHIBIT HAS BEEN
REDACTED IN ITS ENTIRETY**

EXHIBIT 16

Westlaw.

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C

Barber v. United Airlines, Inc.

C.A.7 (Ind.),2001.

This case was not selected for publication in the
 Federal Reporter. NONPRECEDENTIAL
 DISPOSITION To be cited only in accordance with
 Fed.R.App.P. 32.1.

United States Court of Appeals, Seventh Circuit.

Geraldine BARBER, Plaintiff-Appellant,

v.

UNITED AIRLINES, INC. Defendant-Appellee.

No. 00-3546.


Argued May 15, 2001.

Decided Aug. 16, 2001.


Passenger brought action against airline to recover for injuries sustained when plane encountered turbulence. The United States District Court for the Northern District of Indiana, Andrew Rodovich, United States Magistrate Judge, entered judgment as matter of law in favor of airline, and passenger appealed. The Court of Appeals held that: (1) aviation expert was properly excluded from testifying; (2) refusal to grant continuance was not abuse of discretion; and (3) passenger's unsubstantiated testimony was insufficient to create fact issue.

Affirmed.

West Headnotes

[1] Evidence 157  **555.2****157 Evidence****157XII Opinion Evidence****157XII(D) Examination of Experts****157k555 Basis of Opinion****157k555.2 k. Necessity and Sufficiency.****Most Cited Cases**


Trial judge must determine whether expert's opinion is grounded in methods and procedures of science, and whether opinion has sufficient factual underpinnings. Fed.Rules Evid.Rule 702, 28 U.S.C.A.

[2] Evidence 157  **555.7****157 Evidence****157XII Opinion Evidence****157XII(D) Examination of Experts****157k555 Basis of Opinion****157k555.7 k. Due Care and Proper****Conduct. Most Cited Cases**

Aviation expert's failure to explain why he ignored weather data and testimony given by pilots to extent that those facts conflicted with his opinion that pilots were negligent for failing to properly use radar while flying through area where thunderstorms were predicted precluded expert from testifying in passenger's negligence action against airline; expert did not give any additional data or information that he relied upon. Fed.Rules Evid.Rule 702, 28 U.S.C.A.

[3] Federal Courts 170B  **823****170B Federal Courts****170BVIII Courts of Appeals****170BVIII(K) Scope, Standards, and Extent****170BVIII(K)4 Discretion of Lower Court****170Bk823 k. Reception of Evidence.****Most Cited Cases**

Court of Appeals reviews district court's decision to exclude expert testimony for abuse of discretion. Fed.Rules Evid.Rule 702, 28 U.S.C.A.

[4] Evidence 157  **514(1)****157 Evidence****157XII Opinion Evidence****157XII(B) Subjects of Expert Testimony****157k514 Management and Operation of****Vehicles, Machinery, and Appliances****157k514(1) k. In General. Most Cited****Cases**

District court's refusal to permit aviation expert to testify in passenger's negligence action against airline as to fact that thunderstorms could create severe turbulence was not abuse of discretion, where airline's pilots admitted that thunderstorms were known to cause severe turbulence, but undisputed evidence indicated that turbulence that plane struck was clear-air turbulence, not thunderstorm-related turbulence. Fed.Rules Evid.Rule 702, 28 U.S.C.A.

[5] Federal Civil Procedure 170A  **1852****170A Federal Civil Procedure****170AXII Continuance****170Ak1852 k. Discretion of Court. Most Cited****Cases**

District court has broad discretion in determining

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whether to grant continuance.

[6] Federal Civil Procedure 170A 1856

170A Federal Civil Procedure

170AXII Continuance

170Ak1855 Grounds

170Ak1856 k. Absence of Witness or Evidence in General. Most Cited Cases

District court's refusal to grant continuance in passenger's negligence action against airline in order to give passenger more time to retain aviation expert after her expert was rejected was not abuse of discretion, where case was almost two and a half years old, it had already been continued and delayed so as to allow passenger opportunity to obtain expert witnesses, passenger had plenty of time to evaluate proffered expert's report and deposition, and airline had filed motion in limine within time established by court.

[7] Federal Courts 170B 776

170B Federal Courts

170BVIII Courts of Appeals

170BVIII(K) Scope, Standards, and Extent

170BVIII(K)1 In General

170Bk776 k. Trial De Novo. Most Cited

Cases

Court of Appeals reviews district court's grant of judgment as matter of law de novo. Fed.Rules Civ.Proc.Rule 50, 28 U.S.C.A.

[8] Federal Civil Procedure 170A 2515

170A Federal Civil Procedure

170AXVII Judgment

170AXVII(C) Summary Judgment

170AXVII(C)2 Particular Cases

170Ak2515 k. Tort Cases in General.

Most Cited Cases

Passenger's unsubstantiated testimony that pilot told her immediately after flight that they had flown through thunderstorm was insufficient to create fact issue in passenger's action to recover for injuries sustained when plane encountered turbulence as to whether pilot had duty to warn of possible turbulence, where undisputed testimony indicated that turbulence was clear-air turbulence, not thunderstorm-related turbulence, passenger did not make claim until she took stand at trial, claim contradicted passenger's deposition testimony, pilot's testimony, and testimony of all other witnesses, and passenger submitted no weather reports confirming

thunderstorms at that time and in that location.

[9] Carriers 70 295.1

70 Carriers

70IV Carriage of Passengers

70IV(D) Personal Injuries

70k294 Management of Conveyances

70k295.1 k. Air Carriers. Most Cited

Cases

Pilot had no duty to warn passengers to fasten their seatbelts when he saw clouds and haze in front of him, and thus airline was not liable for injuries sustained by passenger when plane struck turbulence, where cirrus clouds observed by pilot were not capable of causing type of turbulence they experienced.

[10] Carriers 70 305(4)

70 Carriers

70IV Carriage of Passengers

70IV(D) Personal Injuries

70k305 Proximate Cause of Injury

70k305(4) k. Management of

Conveyances. Most Cited Cases

Pilot's alleged failure to properly use plane's radar during flight was not proximate cause of injuries sustained by passenger when plane encountered turbulence, where clear-air turbulence that caused passenger's injuries could not have been detected by radar.

[11] Evidence 157 78

157 Evidence

157II Presumptions

157k74 Evidence Withheld or Falsified

157k78 k. Suppression or Spoliation of

Evidence. Most Cited Cases

Airline's destruction of documents pertaining to weather at time of flight did not give rise to inference that missing evidence was favorable to passenger seeking to recover for injuries sustained when plane encountered turbulence, where documents were destroyed in ordinary course of business, and passenger obtained independent reports as to actual conditions that day.

Appeal from the United States District Court for the Northern District of Indiana, Hammond Division. No. 98 C 119. Andrew Rodovich, Magistrate Judge.

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Before RIPPLE, MANION, DIANE P. WOOD,
 Circuit Judges.

ORDER

****1** United Airlines Flight 516 from New Orleans to Chicago encountered turbulence on May 3, 1996. One of the passengers on board, Geraldine Barber, was injured, and she sued United Airlines for negligence. Prior to trial, the district court granted United Airlines' motion in limine, barring Barber's proffered aviation expert, Dr. Michael Hynes. The trial proceeded, but at the close of evidence the district court granted United Airlines judgment as a matter of law. Barber appeals, and we affirm.

I. Background

On May 3, 1996, Geraldine Barber was returning to the Chicago area aboard United Airlines Flight 516 from an educational conference held in New Orleans. Flight 516 was in Captain James Kainer's charge, and First Officer James O'Neal was second in command. The initial leg of the flight was smooth, but about forty miles south of St. Louis the plane encountered moderate to severe turbulence, which caused the plane to suddenly pitch up severely and then level off.

The incident lasted only a few moments, and the remainder of the flight was uneventful, but at the time the plane struck the turbulence, the "fasten seatbelt" sign was off and Geraldine Barber, whose seatbelt was loosely fastened, was thrown forward. She struck her head and shoulders against the seat in front of her. Barber claims that as a result she suffered shock, fright, and severe pain, and that the accident tore her rotator cuff, which required surgery. Barber also claims that while at work the following year, she fell after having tried to lift herself up using her injured shoulder. As a result, Barber claims that she suffered severe damage to her knee which also required surgery. Barber further contends that her injuries eventually caused her to take early retirement from her job as a school administrator.

Almost two years after the incident, Barber sued United Airlines alleging that United Airlines was negligent because it flew through an area where thunderstorms were predicted, because the pilot failed to properly use the radar, and because the pilots failed to avoid the weather system which caused the turbulence. To support ***436** her case, Barber retained Dr. Michael Hynes as an aviation

expert, but prior to trial, on United Airlines' Motion in Limine, the district court ^{FN1} barred Hynes's testimony, concluding that Hynes's methodology was flawed because he ignored weather data and testimony given by the pilots to the extent that those facts conflicted with his opinion.

FN1. The parties consented to trial by a magistrate judge pursuant to 28 U.S.C. § 636(c)(1). For simplicity, we refer to the trial court as the district court.

Barber then presented her case to the jury without Dr. Hynes's testimony. At trial, Captain James Kainer testified that from the moment of takeoff in New Orleans to approximately 100 miles south of St. Louis, the flight "was smooth, visibility was good, the seatbelt sign was off, it was a routine flight." He further testified that about forty miles outside of St. Louis, he turned on the plane's radar.^{FN2} Captain Kainer explained that it takes about ten seconds for the radar to warm up, and that after he had turned it on and it had warmed up, he had a clear picture which showed no "convective or precipitative activity." However, a few minutes later, as Captain Kainer was tweaking the radar,^{FN3} the aircraft struck clear air turbulence, pitching up. Captain Kainer explained that clear air turbulence cannot be seen either visually or on radar. He further testified that he had flown the same route earlier in the day and had not experienced any turbulence, nor did any other pilots report incidents of clear air turbulence along that route. Additionally, Captain Kainer stated that while thunderstorms were predicted in the area for later in the day, at the time that the plane struck the turbulence there were no thunderstorms.

FN2. Captain Kainer explained that a plane's radar is not always kept on; rather, pilots switch the radar on only when they believe there is a need for it. Captain Kainer explained that he turned the radar on because he knew that storms were predicted for later in the evening and he wanted to see what the weather would be like on his drive home from the Chicago airport, and to get an overview of the weather coming into Illinois.

FN3. Captain Kainer also explained that the radar picture must be continuously "tweaked," i.e., adjusted for distance and/or intensity.

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**2 Geraldine Barber then took the stand. She testified that after the plane landed, while she was waiting inside the Chicago airport to go home, Captain Kainer approached her, telling her that he had flown through a thunderstorm and that he did not have his radar on. This was the first time that Barber made such a claim; she did not mention these statements in either her deposition or in a diary that she kept following the incident. Barber claimed that she remembered Captain Kainer's remarks after having seen him testify the previous day, which according to Barber jogged her memory.

Following the close of Barber's case, United Airlines moved for Judgment as a Matter of Law, arguing that Barber failed to present any evidence that United Airlines was negligent. Specifically, United Airlines asserted that because the undisputed evidence established that the turbulence was "clear air" turbulence which cannot be seen, and was not turbulence associated with thunderstorms, United Airlines was not liable for Barber's injuries. The district court agreed, granting United Airlines' Motion for Judgment as a Matter of Law. Barber appeals.

II. Analysis

A. Motion in Limine

On appeal, Barber initially argues that the district court erred in barring Dr. *437 Hynes's expert testimony. Federal Rule of Evidence 702 provides that

If scientific, technical or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, or training or education may testify thereto in the form of an opinion or otherwise.

[1] In Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993), the Supreme Court held that Rule 702 "imposes on the trial court the obligation, when dealing with expert witnesses, to ensure that scientific testimony is 'not only relevant but reliable.'" Goodwin v. MTD Products, Inc., 232 F.3d 600, 608 (7th Cir.2000) (quoting Daubert, 509 U.S. at 589, 113 S.Ct. 2786). This requires a trial judge to determine whether an expert's opinion was

grounded in the methods and procedures of science, and whether the opinion had sufficient factual underpinnings. *Id.*

[2] A review of Dr. Hynes's proffered expert opinion, his deposition testimony, and the overall record confirms the district court's conclusion that in formulating his opinion, "Dr. Hynes relied on weather data, but he rejected some weather data that contradicted his opinion." The district court also accurately noted that Dr. Hynes "rejected the testimony of the pilot and the copilot, which contradicted his opinion, [and] in formulating his opinion, Dr. Hynes did not give any additional data or information that he relied upon, which formed the basis of rejecting some of the weather data and the opinions of the copilots." Dr. Hynes also did not adequately explain why he ignored certain facts and data, while accepting others. Nor did Dr. Hynes present any other data which supported his opinion—he merely accepted some of the testimony and weather data that suited his theory and ignored other portions of it that did not. Because in formulating his opinion Dr. Hynes cherry-picked the facts he considered to render an expert opinion, the district court correctly barred his testimony because such a selective use of facts fails to satisfy the scientific method and *Daubert*, and it thus fails to "assist the trier of fact." Fed.R.Civ.Proc. 702.

**3 [3] On appeal, Barber does not challenge the district court's reasoning that Dr. Hynes's proffered expert opinion failed to satisfy *Daubert* because of his selective use of data. Rather, she argues that instead of prohibiting Dr. Hynes from testifying entirely, he should have been allowed to testify about the effect of thunderstorms, namely that they are known to cause severe turbulence. She also believes that the district court should have allowed him to testify concerning the steps that United Airlines could have taken to avoid the turbulence or to warn passengers. We review the district court's decision to exclude expert testimony for an abuse of discretion. United States v. Crotteau, 218 F.3d 826, 831 (7th Cir.2000).

[4] Barber's argument ignores the fact that the pilots themselves admitted the obvious—that thunderstorms are known to cause turbulence, including severe turbulence, and that company policy is to re-route flights to avoid thunderstorms and to warn passengers to fasten their seatbelts. Because these points were already established—and by the defendants' own employees—we do not believe the district court abused its discretion by failing to allow Dr. Hynes to

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likewise opine on the effects of thunderstorms. Moreover, the real question was not whether thunderstorms cause turbulence or whether United Airlines could have re-routed the flight, but whether the turbulence which Flight 516 struck was clear air turbulence or thunderstorm-related turbulence. As explained*438 below, the evidence presented during trial established that the turbulence was clear air turbulence. Therefore, even had Dr. Hynes been allowed to testify on more limited grounds, he would have added nothing new and United Airlines would still have been entitled to judgment as a matter of law.^{FN4}

^{FN4}. Barber also argues that the district court should have held an evidentiary hearing to determine whether Dr. Hynes was qualified to testify on a more limited basis. There was no need for an evidentiary hearing, however, given the extensive briefing on the issue and the district court's more than thorough review of Dr. Hynes's proffered expert opinion and deposition testimony. Also, as just noted, even if Dr. Hynes were allowed to testify on more limited grounds, that would not have altered the outcome of this case, and therefore we find no abuse of discretion in the district court's decision not to hold an evidentiary hearing.

[5][6] Barber also argues that the district court should have granted her a continuance so as to allow her more time to retain another expert witness. A district court has broad discretion in determining whether to grant a continuance. *Brooks v. United States*, 64 F.3d 251, 256 (7th Cir.1995). In this case, the district court refused to grant a continuance, noting that the case was almost two and a half years old and that it had already been continued and delayed so as to allow the plaintiff the opportunity to obtain expert witnesses. The district court also noted that the plaintiff had plenty of time to evaluate Dr. Hynes's report and deposition and that the defendant had filed the motion in limine within the time established by the court. Under these circumstances, the district court did not abuse its broad discretion in denying Barber's request for a continuance.

B. Judgment as a Matter of Law

Following the close of Barber's case, United Airlines moved for Judgment as a Matter of Law pursuant to

Federal Rule of Civil Procedure 50, arguing that Barber had failed to present sufficient evidence to support her theory of negligence. Specifically, United Airlines asserted that while thunderstorms may cause turbulence, and while thunderstorms were predicted in the area of the flight for later in the day, there was no evidence that the turbulence which Flight 516 encountered was caused by thunderstorms. Rather, the only evidence presented during Barber's case-in-chief established that the turbulence which caused Barber's alleged injuries was clear air turbulence, which cannot be seen visually or by radar. Thus, United Airlines could not have avoided the turbulence or warned the passengers to fasten their seatbelts. The district court agreed with United Airlines and granted it judgment as a matter of law.

**4 [7] We review a district court's grant of judgment as a matter of law *de novo*, "asking whether the evidence presented, combined with all the reasonable inferences permissibly drawn therefrom, is sufficient to support the verdict when viewed in the light most favorable to the party against whom the motion is directed." *Lane v. Hardee's Food Systems, Inc.*, 184 F.3d 705, 707 (7th Cir.1999).

In this case, Barber did not introduce enough evidence to support her claim. Specifically, she failed to introduce any evidence demonstrating that United Airlines could have predicted (and thus either have avoided or warned passengers about) the turbulence which caused her alleged injuries. Rather, the undisputed evidence established that the turbulence which Flight 516 struck was what is called "clear air turbulence." Clear air turbulence cannot be seen either visually or by radar. Additionally, the evidence established that United Airlines had no other warning of *439 the clear air turbulence, as Captain Kainer had flown the same route earlier in the day and had not experienced any clear air turbulence, and no other pilots who had flown that same route had called in reports of turbulence. Because there was no way that United Airlines could have known of the presence of clear air turbulence, it could not have avoided the turbulence or warned Barber of its presence.

[8] Barber responds by arguing that she was entitled to get to the jury because she presented evidence that Captain Kainer had flown through a thunderstorm. The evidence she refers to is her own trial testimony; Barber testified that after the incident while she was waiting inside the airport to return home, Captain Kainer came up to her and told her that he had flown through a thunderstorm. This (i.e. at trial) was the

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first time that she made such a claim, having never mentioned this alleged statement in the pleadings or during discovery. In fact, she was thoroughly questioned in her pre-trial deposition about her conversation with the pilots immediately after the flight. She then said that one pilot told her they had no prior warning of bad weather. He thought it was fog. She said nothing about the pilot telling her they flew through a thunderstorm. Barber claims that she only remembered this statement after she saw Captain Kainer testifying at trial.

Initially, we note that no other witnesses claimed that the plane flew through a thunderstorm. In fact, several of Barber's coworkers (including her sister) testified that the day was sunny and beautiful, and they mentioned nothing about a storm. Nor were there any weather reports confirming thunderstorms at that time and in that location. In fact, the weather reports for that day in St. Louis, Missouri showed only a trace of water at 3:00 p.m., and by 4:00 p.m. there was only 1/100 of an inch of rain, and by that time Flight 516 had passed through St. Louis and had landed at O'Hare. Both pilots also testified as to the weather conditions, and stated specifically that they did not fly through a thunderstorm. Captain Kainer also testified that the weather information he had received prior to leaving New Orleans was that "there was some activity that was developing that was supposed to come into the Midwest maybe at the end of the evening, into that night," but the flight took place in the early-to-mid afternoon. Thus, Barber's last-minute recollection contradicts all of the other evidence, including her own deposition. And while we must be careful to avoid "supplanting our view of the credibility or the weight of the evidence for that of the jury," to avoid judgment as a matter of law a party must present "more than a mere scintilla of evidence." *Lane*, 184 F.3d at 706 (internal quotation omitted). In light of the entire record and the overwhelming contradictory evidence, Barber's self-serving statement that Captain Kainer had told her that he had flown through a thunderstorm constitutes, at best, a mere scintilla of evidence, and thus is insufficient to support her claim of negligence.^{FNS}

^{FNS} This statement also does not contradict the other trial evidence which established that the turbulence was clear air turbulence, as opposed to thunderstorm-related turbulence. Thus, even considering this statement, Barber still has not presented any evidence that thunderstorms in the area caused the turbulence which led to her

alleged injuries.

^{**5} [9] Next, Barber argues that the evidence supports her theory that United Airlines was negligent in failing to warn the passengers that it was approaching a weather system and that turbulence was possible. In support of this theory, Barber points to Captain Kainer's testimony that prior to striking the turbulence, he saw clouds and haze in front of him. Accordingly,^{*440} even if there were no thunderstorms in the vicinity, Barber asserts that because Captain Kainer saw clouds and a haze before experiencing the turbulence, he could have warned the passengers to fasten their seatbelts. While it is true that Captain Kainer stated that he saw clouds prior to striking the turbulence, he explained that they were "little cirrus type clouds, just-it might have been a haze layer," and that such clouds cannot cause the type of turbulence they experienced. Barber did not present any evidence to the contrary. Moreover, she had the opportunity to cross-examine Captain Kainer and to ask whether it were possible that the clouds were something else or could have caused the turbulence. Yet that was not the testimony; rather, Captain Kainer explained that the clouds were unrelated to a weather system and could not have caused the turbulence they experienced. Therefore, there is insufficient evidence to support this theory as well.

[10] Barber further contends that the evidence created a reasonable inference that Captain Kainer failed to properly use the plane's radar, having turned it on only seconds before the incident. She argues that this constituted negligence. Initially, we note our skepticism of Barber's portrayal of the evidence. While Captain Kainer did note that he had turned on the radar only a few minutes before the plane pitched up, he definitively stated that the radar was on, warmed up, and that he had a clear picture of the flight path prior to encountering any turbulence. Barber challenges this evidence with her own last-minute recollection that Captain Kainer had told her that he did not have the radar on at all. This testimony contradicted her own diary in which she stated that Captain Kainer had told her that he got no warning from the radar. In any event, even if Captain Kainer failed to properly use the radar during the flight, Barber still could not succeed on her negligence theory because the evidence established that the turbulence which caused her alleged injuries was clear air turbulence, and that clear air turbulence can not be detected by radar. Therefore, any alleged negligence did not cause Barber's alleged injuries.

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C. Standard of Care

On appeal, Barber also argues that the district court improperly determined the appropriate standard of care. Prior to trial, the district court concluded that 14 C.F.R. § 91.13(a) establishes the standard of care at issue: "No person may operate an aircraft in a careless or reckless manner so as to endanger the life or property of another." Barber asserts that the appropriate standard is set forth in 49 U.S.C. § 44701(1)(A), which provides "the duty of an air carrier [is] to provide service with the highest possible degree of safety in the public interest." Barber also cites the standard of care section in Section 44702 which recognizes "the duty of an air carrier to provide service with the highest possible degree of safety in the public interest." 49 U.S.C. § 44702. Thus, according to Barber, United Airlines owed her a duty of the "highest possible" care. We need not decide this issue today, however, because no matter how high the standard of care, as discussed above, Barber has failed to present sufficient evidence to support her claim against United Airlines under any standard of care because there is no evidence from which a reasonable jury could conclude that United Airlines could have foreseen (and thus warned about or avoided) the turbulence.

D. Missing Evidence Instruction

****6 [11]** Finally, Barber argues that the district court erred in concluding that she was not entitled to a missing evidence instruction. Specifically, Barber contends that United Airline's failure to present certain⁴⁴¹ documents pertaining to the weather at the time of the flight justifies giving a missing evidence instruction. In support of her position, she cites Niehus v. Liberio, 973 F.2d 526, 530 (7th Cir.1992), wherein this court explained that such an instruction may be appropriate if "there is evidence that a party would surely have introduced it had it been helpful, permitting an inference that the evidence would instead have helped his opponent." First, since this case never got to the jury, any issue of jury instructions is moot. Second, to the extent that Barber is really arguing that in considering the motion for judgment as a matter of law the district court should have inferred that the weather data destroyed by United Airlines favored Barber's case, no such inference is appropriate here because the evidence established that the records were destroyed in the ordinary course of business. Moreover, the records Barber complains were destroyed consisted

merely of the weather forecast provided to the pilots prior to the flight, and since Barber obtained independent reports as to the actual conditions that day, the missing reports would still be insufficient to create an issue of fact for the jury because those reports merely predicted weather conditions. The evidence established the actual conditions the plane encountered, namely, clear air turbulence which cannot be seen and thus cannot be avoided or warned against.

III. Conclusion

While there is no dispute that United Airlines Flight 516 struck turbulence en route from New Orleans to Chicago and that the plaintiff Geraldine Barber was injured, Barber has failed to present sufficient evidence to establish negligence on United Airlines' part, no matter how high the standard of care, because the undisputed evidence establishes that the turbulence was clear air turbulence which could not have been predicted. The district court also did not abuse its discretion in barring Barber's proffered expert because in formulating his opinion Dr. Hynes selectively considered the pilots' testimony and the weather reports and thus his opinion lacked a scientific basis. For these and the foregoing reasons WE AFFIRM.

RIPPLE, Circuit Judge. I concur in the result.
 C.A.7 (Ind.),2001.

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EXHIBIT 17

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Callaway Golf Co. v. Dunlop Slazenger Group
 Americas, Inc.
 D.Del., 2004.

Only the Westlaw citation is currently available.

United States District Court, D. Delaware.

CALLAWAY GOLF COMPANY,
 Plaintiff/Defendant-in-Counterclaim,

v.

DUNLOP SLAZENGER GROUP AMERICAS,
 INC., d/b/a Maxfli, Defendant/Plaintiff-in-
 Counterclaim.

No. Civ.A. 01-669-KAJ.

May 21, 2004.

Jack B. Blumenfeld, Morris, Nichols, Arsht &
 Tunnell, Wilmington, DE, for Plaintiff/Counter
 Defendant.

David J. Ferry, Jr., Ferry, Joseph & Pearce, P.A.,
 Wilmington, DE, for Defendant/Counter Claimant.

MEMORANDUM ORDER

JORDAN, J.

I. Introduction

*1 Presently before me is a motion by Callaway Golf Company ("Callaway") to exclude the testimony of Dr. Lewis M. Koppel ("Dr.Koppel") (Docket Item ["D.I."] 316), a motion by Callaway to exclude portions of Dr. John Jepson's ("Dr.Jepson") testimony (D.I.318), and a motion by Callaway to exclude the testimony of Dr. Daniel Klempner ("Dr.Klempner") (D.I.320), all expert witnesses of Dunlop Slazenger Group Americas, Inc. d/b/a Maxfli ("Dunlop"). Also before me is a motion by Callaway for partial summary judgment on grounds that Dunlop cannot prove damages on its trade secret, common law, or false advertising claims. (D.I.312.) I have jurisdiction over this case pursuant to 28 U.S.C. §§ 1331, 1338, and 1367. For the reasons set forth below, the motion to exclude Dr. Koppel's testimony will be granted in part and denied in part, the motion to exclude portions of Dr. Jepson's testimony will be granted, and the motion to exclude Dr. Klempner's testimony will be granted. The motion for partial summary judgment will be denied.

II. Background

Because the factual and procedural history of this case is set forth in three prior rulings, *see* Memorandum Opinion dated May 13, 2004 (D.I.359), Memorandum Opinion dated May 18, 2004 (D.I.362), and Memorandum Order dated May 18, 2004 (D.I.360), it will not be repeated herein. Rather, the facts pertinent to the motions currently before me are incorporated in the discussion below.

III. Standard of Review

The motions to exclude evidence are committed to the court's discretion. *See In re Paoli R.R. Yard PCB Litig.* 35 F.3d 717, 749, 777-78 (3d Cir.1994) (on a motion to exclude proffered expert testimony, the trial court's inquiry is a flexible one, and its decision to admit or exclude expert testimony is reviewed under an "abuse of discretion" standard).

The summary judgment standard is well known. *Rule 56 of the Federal Rules of Civil Procedure* provides that summary judgment shall be entered if "there is no genuine issue as to any material fact and ... the moving party is entitled to judgment as a matter of law." "[T]he availability of summary judgment turn[s] on whether a proper jury question ... [has been] presented." *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 249, 106 S.Ct. 2505, 91 L.Ed.2d 202 (1986). "[T]he judge's function is not himself to weigh the evidence and determine the truth of the matter but to determine whether there is a genuine issue for trial." *Id.* In making that determination, the Court is required to accept the non-moving parties' evidence and draw all inferences from the evidence in the non-moving parties' favor. *Id.* at 255; *Eastman Kodak Co. v. Image Technical Servs., Inc.*, 504 U.S. 451, 456, 112 S.Ct. 2072, 119 L.Ed.2d 265 (1992). Nevertheless, the non-moving party must, in opposing a summary judgment motion, "identify those facts of record which would contradict the facts identified by the movant." *Port Authority of New York and New Jersey v. Affiliated FM Ins. Co.*, 311 F.3d 226, 233 (3d Cir.2002) (internal quotes omitted).

IV. Discussion

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*2 Federal Rule of Evidence 702 obligates judges to ensure that any scientific testimony or evidence admitted is relevant and reliable. See Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579, 589, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993). The Rule provides that "if scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training or education, may testify thereto in the form of an opinion or otherwise." Fed.R.Evid. 702 (2003). The party offering the expert testimony has the burden of proving admissibility. Daubert, 509 U.S. at 592 n. 10. The subject of an expert's testimony must be grounded in the methods and procedures of science and based on more than a subjective belief or speculation. *Id.* at 589-590. Further, Rule 702 requires that expert testimony assist the trier of fact, in other words, it must "fit" the issues in the case by having a "valid scientific connection to the pertinent inquiry." *Id.* at 591-92.

In determining "whether the expert is proposing to testify to (1) scientific knowledge that (2) will assist the trier of fact," the court must assess whether the methodology underlying the testimony is scientifically valid and whether it can properly be applied to the facts in issue. *Id.* at 592-93. As part of that inquiry, the court must examine the expert's conclusions in order to determine whether they reliably follow from the facts known to the expert and the methodology used. See Heller v. Shaw Indus., Inc., 167 F.3d 146, 153 (3d Cir.1999).

A party cannot qualify a person as an expert generally by showing that the expert has specialized knowledge or training which would qualify him or her to opine on some other issue. Redman v. John D. Brush & Co., 111 F.3d 1174, 1179 (4th Cir.1997); Barrett v. Atl. Richfield Co., 95 F.3d 375, 382 (5th Cir.1996). Moreover, testimony of an expert that constitutes mere personal belief as to the weight of the evidence invades the province of the fact-finder. McGowan v. Cooper Indus., Inc., 863 F.2d 1266, 1273 (6th Cir.1987); STX, Inc. v. Brine, Inc., 37 F.Supp.2d 740, 768 (D.Md.1999) (quotation omitted), *aff'd*, 211 F.3d 588 (Fed.Cir.2000); SEC v. Lipson, 46 F.Supp.2d 758, 763 (N.D.Ill.1998).

A. Dr. Koppel

Dunlop has retained Dr. Koppel, as an expert, to quantify Dunlop's economic damages resulting from Callaway's alleged misappropriation of trade secrets

described in the documents that Henry Felipe ("Felipe") took with him to Callaway after he was laid off at Dunlop (the "Felipe binder"),^{FN1} and from Callaway's alleged misappropriation of Dunlop's polyurethane technology through Pijush Dewanjee ("Dewanjee").^{FN2} (D.I. 327 at 24; D.I. 322 at Ex. A; D.I. 327 at 5-16.) First, Dr. Koppel estimated that Callaway was unjustly enriched in the amount of \$10.4 million because of avoided research and development costs through Callaway's use of the Felipe binder. (D.I. 327 at 25.) Second, Dr. Koppel asserts that Dunlop lost profits in the amount of \$8.1 million from decreased golf ball sales during the years 2000 through 2006 because of Callaway's use of the Felipe binder. (*Id.* at 25-26.) Third, Dr. Koppel claims that Dunlop is entitled to approximately \$11.3 million in royalty damages for the research and development costs that Callaway avoided by having the information in the Felipe binder rather than creating it independently, and for the head start, or accelerated market entry, that Callaway received by using that information. (*Id.* at 26.) Finally, Dr. Koppel claims that Dunlop is entitled to about \$11.3 million in royalty damages for Callaway's misappropriation of Dunlop's polyurethane technology.^{FN3}

FN1. The Felipe binder includes Dunlop's "Golf Ball Specifications and Process Manual."

FN2. In my May 13, 2004 Memorandum Opinion, I held as a matter of law that Callaway, through Dewanjee, had not misappropriated trade secrets. (D.I.359.)

FN3. Specifically, Dunlop claims that "Dr. Koppel uses the connection between [Dunlop's] Polyurethane Trade Secrets and [Callaway's U.S. Patent No. 6,117,024 (the "'024 patent'")] to substantiate his use of analyses most commonly used in patent valuation." (D.I. 327 at 27.)

*3 Callaway argues that Dr. Koppel's testimony should be excluded under Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993) because Dr. Koppel's methodology and conclusions "are speculative and unreliable, do not fit the facts and circumstances of this case, and are inconsistent with damage measures required by law." (D.I. 317 at 2.) First, Callaway argues that Dr. Koppel's unjust enrichment analysis, which considers Callaway's avoided research and

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development costs, does not take into account the extent to which Callaway actually used or benefitted from the information contained in the Felipe binder. (*Id.*) Callaway states that Dr. Koppel "deliberately chose to assess [Callaway's] avoided [research and development] expenses by calculating the amount that [Callaway] would have had to spend to recreate all of the information contained in the Felipe [binder] without analyzing what information from the Felipe [binder] [Callaway] actually used." (*Id.* at 15.) Callaway also claims that Dr. Koppel did not consider whether Callaway's research and development spending would have been different if it did not have the Felipe binder, and, as a result, included the cost of an item in his avoided research and development costs even if Callaway incurred the cost. (*Id.*)

Second, Callaway argues that Dr. Koppel's \$10.4 million damages figure makes numerous erroneous factual assumptions, including the assumption that the Felipe binder contains information on 82 different golf balls ^{FN4} (*Id.* at 16-17), the assumption that the Felipe binder describes 82 different paint systems ^{FN5} (*Id.* at 18-19), and the assumption that the Felipe binder contains information on patent searches and competitive golf ball analyses. ^{FN6} (*Id.* at 19-20.)

^{FN4}. Callaway asserts that there are 82 separate specification sheets contained in the Felipe binder, but many of those describe identical golf balls.

^{FN5}. Callaway claims that there are at most two paint systems described in the Felipe binder.

^{FN6}. Competitive golf ball analyses provide information about other companies' balls, which is obtained by taking the balls apart and examining them. Callaway says that there is no information about patent searches or competitive golf ball analyses in the Felipe binder.

Third, Callaway argues that Dr. Koppel's measure of damages for the profits Dunlop lost as a result of Callaway's entrance into the golf ball market sooner than it would have if Callaway did not have the Felipe binder damages is not supported by evidence. Specifically, Callaway claims that Dr. Koppel's opinion that it should have taken Callaway five years to develop its first golf ball is flawed and that Dr. Koppel erroneously assumes that Callaway would

have made no golf ball sales until 2007 without the Felipe binder. (*Id.* at 21-22.)

Fourth, Callaway argues that Dr. Koppel's calculation for royalties should be excluded because it is based on his avoided research and development costs and lost profits conclusions, which, according to Callaway, are inadmissible. (*Id.* at 23.)

Finally, Callaway argues that Dr. Koppel should be excluded from testifying on the damages allegedly resulting from Callaway's use of the '024 patent because, among other things, Callaway did not misappropriate Dunlop's trade secrets in the '024 patent. (*Id.* at 23-28.)

As to that fifth and final argument, because Callaway did not misappropriate trade secrets related to polyurethane technology, as I held in the May 13, 2004 Memorandum Opinion (D.I.359), Dr. Koppel's testimony on those points will be excluded. However, as to Dr. Koppel's testimony regarding the information contained in the Felipe binder, Callaway's arguments are matters for cross examination because Dr. Koppel's opinions, while arguably flawed and open to attack, are not so devoid of fit or reliability as to be inadmissible. Therefore, the motion to exclude Dr. Koppel's testimony will be granted in part and denied in part.

B. Dr. Jepson

*4 Dunlop has retained Dr. Jepson, who "has worked in the golf industry for some 30 years" (D.I. 328 at 12), to testify regarding "Callaway's accelerated entry into the golf ball market as a result of misappropriating Dunlop's alleged proprietary information. (*Id.* at 7.) Dunlop states that Dr. Jepson "is not a 'forensic economic expert' who will offer a formal valuation opinion," and that it "has no intent to offer any calculations by [Dr.] Jepson as a competing valuation to the economic analysis offered by Dr. Lewis Koppel." (*Id.* at 6-7.) Rather, Dunlop claims that "Dr. Jepson's opinions merely add 'real world' corroboration to [Dr.] Koppel[s] valuation" and "suggest[] that [Dr.] Koppel[s] valuations are conservative." (*Id.* at 1.) Callaway asserts that Dr. Jepson has opined that Callaway's alleged misappropriation of the Felipe binder and Dunlop's polyurethane technology resulted in at least \$74 million in unjust enrichment to Callaway. (D.I. 319 at 4; D.I. 323 at Ex. J, pp. 12-13.)

Callaway does not challenge Dr. Jepson's opinions

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that the trade secrets at issue are "valuable," and that Callaway allegedly acquired "valuable information" that "greatly accelerated Callaway's entry into the golf ball market." (D.I. 344 at 3) (quoting D.I. 328 at 2, 11, 17). Remarkably, Callaway also does not challenge Dr. Jepson's "generic" opinion that "Dr. Koppel's forensic damages number is conservative." (D.I. 344 at 3.) Rather Callaway argues that Dr. "Jepson's testimony should not extend to asserting dollar figures purporting to 'quantify' the value of the trade secret information" because Dr. Jepson's unjust enrichment values and dollar amounts fail to meet the reliability and relevance standards under Fed.R.Evid. 702 and Daubert. (D.I. 344 at 3-4.) I agree.

Dunlop's Answering Brief and Dr. Jepson's expert report both fail to explain how Dr. Jepson arrived at his claim that Callaway was unjustly enriched by \$74 million from the misappropriation of Dunlop's trade secrets. (See D.I. 328; D.I. 323 at Ex. J.) Therefore, Dr. Jepson's unjust enrichment estimate appears to be based solely on his personal knowledge and experience rather than any methodology, analysis, or factual support. Under Daubert, such evidence is not reliable. See Primavera Familienstiftung v. Askin, 130 F.Supp.2d 450, 530 (S.D.N.Y.2001) (An expert "must do more than simply aver conclusorily that his experience led to his opinion"); LinkCo., Inc., v. Fujitsu Ltd., No. 00 Civ. 7242(SAS), 2002 WL 1585551 at *4 (S.D.N.Y. July 16, 2002) ("[A] court cannot permit experts to 'offer credentials rather than analysis' ") (citation omitted). In addition to proffering unreliable testimony, Dunlop concedes that Dr. Jepson is "not qualified to independently opine on trade secrets quantification." (D.I. 328 at 2.) Therefore, Callaway's motion to exclude Dr. Jepson from opining or testifying as to the dollar amounts set forth in his expert report will be granted.

C. Dr. Klempner

*5 Dunlop has retained Dr. Klempner, a polymer chemist, to testify that Callaway misappropriated Dunlop's trade secrets through Dewanjee's systematic incorporation of each and every ingredient of Dunlop's proprietary polyurethane formula into the initial Callaway cover formula. This includes a polyurethane cover formulation using a diisocyanate with a PTMEG polyol to form a prepolymer, cured with a curing agent blend, such as is disclosed, or should have been disclosed, in the Dunlop February, 1997 Patent Application and/or Dewanjee's Dunlop laboratory notebook. This also includes the use of PPDI as the

diisocyanate component of a polyurethane-based cover formulation, in general, and specifically as the diisocyanate component of Dunlop's polyurethane cover system.

(D.I.329.) Dr. Klempner also opines that Callaway's development of its two polyurethane-based cover formulations was expedited by its use of Dunlop's trade secret technology.

As earlier stated, I have already ruled on summary judgment that Callaway did not misappropriate Dunlop's trade secrets in relation to Dewanjee's work. Therefore, the motion to exclude Dr. Klempner's testimony will be granted.

D. Motion for Partial Summary Judgment

Callaway brings a motion for partial summary judgment on grounds that Callaway cannot prove damages on its trade secret, common law, or false advertising claims. (D.I.312.) Callaway argues that "[i]f this Court grants [Callaway's] motion to exclude Koppel's testimony and damage measures ... [Dunlop] can make no showing that it suffered any damages recoverable under the UTSA-even if [Dunlop] is entitled to summary judgment on [Dunlop's] trade secret claim," and is thus entitled to summary judgment on Dunlop's trade secret misappropriation claim. (D.I. 313 at 6.) Since Callaway's motion to exclude Dr. Koppel's testimony is denied as to the information in the Felipe binder, the summary judgment motion is likewise denied as to Dunlop's misappropriation and common law claims involving that information.^{FN7}

^{FN7}. As to damages related to Dunlop's claim that Callaway misappropriated polyurethane technology, the present motion is moot because summary judgment has already been granted against Dunlop on that claim. (See D.I. 359.)

V. Conclusion

Accordingly, and as explained herein, IT IS HEREBY ORDERED that the motion to exclude Dr. Koppel's testimony (D.I.316) is GRANTED in part and DENIED in part, the motion to exclude the challenged portions of Dr. Jepson's testimony (D.I.318) is GRANTED, and the motion to exclude Dr. Klempner's testimony (D.I.320) is GRANTED. The motion for partial summary judgment on grounds

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that Callaway cannot prove damages on its trade
secret, common law, or false advertising claims
(D.I.312) is DENIED.

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